# Ingleside Precinct Rezoning Planning Proposal

## Biodiversity Assessment Prepared for Department of Planning, Industry and Environment

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Template 2.8.1

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## Abbreviations

| Abbreviation | Description |
|---|---|
| ARA | Adjacent Remnant Area |
| APZ | Asset Protection Zone |
| BC Act | *Biodiversity Conservation Act 2016* |
| BCAA | Biodiversity Certification Assessment Area |
| BCAM | Biodiversity Certification Assessment Methodology |
| BCAR | Biodiversity Certification Assessment Report |
| BCS | Biodiversity Certification Strategy |
| DECCW | NSW Department of Environment, Climate Change and Water (now OEH) |
| DFEC | Duffys Forest Ecological Community |
| DAWE | Commonwealth Department of Agriculture, Water and the Environment (formally DotEE) |
| DP&E | NSW Department of Planning and Environment (formerly NSW Department of Planning) |
| DotEE | Commonwealth Department of the Environment and Energy |
| EEC | Endangered Ecological Community |
| ELA | Eco Logical Australia Pty Ltd |
| EP&A Act | NSW Environmental Planning and Assessment Act 1979 |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| EPP | Eastern Pygmy Possum |

| Abbreviation | Description |
|---|---|
| GBF | Giant Burrowing Frog |
| GDE | Groundwater Dependent Ecosystem |
| HBT | Hollow-bearing Trees |
| HNCMA | Hawkesbury Nepean Catchment Management Area |
| IoM | Improve or Maintain |
| LGA | Local Government Area |
| NPWS | NSW National Parks and Wildlife Service (now part of OEH) |
| OEH | NSW Office of Environment and Heritage (formerly DECCW, DECC, DEC) |
| PCT | Plant Community Type |
| RCT | Red-crowned Toadlet |
| SIC | State Infrastructure levy |
| SEPP | State Environmental Planning Policy |
| SMCMA | Sydney Metropolitan Catchment Management Area (now merged with the HNCMA) |
| TBSA | Threatened Biodiversity Survey and Assessment guidelines |
| TS | Threatened Species |
| TSC Act | NSW *Threatened Species Conservation Act 1995* |
| TSPD | Threatened Species Profile Database |
| VIS | Vegetation Information System |

# Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Cox on behalf of Department of Planning, Industry and Environment (DPIE) to assess ecological outcomes of the proposed land use changes for the Ingleside Precinct. The Ingleside Precinct encompassed an area of approximately 700 hectares. The proposal has since been modified and now covers an area of approximately 176 hectares. The site is located on the Northern Beaches of Sydney, in the Northern Beaches Local Government Area. The objectives of this report are to identify the biodiversity values of the Ingleside Precinct, describe the outcomes of the proposed Masterplan and provide conservation management recommendations.

The report contains information and data that was gathered for a previous Planning Proposal which included a proposal for Biodiversity Certification under the now repealed *Threatened Species Conservation Act 1995* (TSC Act). Whilst Biodiversity Certification is no longer proposed, the data gathered for that proposal gathered during field survey in 2014-16 has been used for this report.

Vegetation survey, collection of biometric transects/plot data, and targeted surveys for threatened species were undertaken by ELA on lands that were accessible. No additional survey was completed in 2020 for the purposes of this updated assessment other than a reconnaissance to confirm there had been no major changes in vegetation cover.

Six plant community types and approximately 69.59 ha of native vegetation have been identified in the precinct with approximately 61.40 proposed for rezoning. The remaining 106 ha were classified as either 'exotic' which comprised non-native planted vegetation and/or weed species, or previously cleared. A large proportion of the native vegetation was assessed as being in good condition, with weed invasion mainly confined to tracks, edges and small isolated areas of disturbance. However, some areas of native vegetation had reduced plant species diversity and moderate to heavy weed presence in the mid-storey and groundcover strata. The poorer condition vegetation communities occurred along watercourses and some minor drainage lines in disturbed catchments, roadsides and adjacent to land-uses involving heavy earthworks and landfill.

One endangered ecological community is located within the Precinct. Coastal Upland Swamp is listed as endangered under the BC Act and under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A total of 23 threatened fauna species and 14 threatened flora species are either known or considered as having potential to occur within the precinct. This includes:

- *Acacia terminalis* subsp. *terminalis*
- *Anthochaera phrygia* (Regent Honeyeater – foraging only)
- *Callistemon linearifolius*
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Calyptorhynchus lathami* (Glossy Black Cockatoo)
- *Cercartetus nanus* (Eastern Pygmy Possum)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Darwinia biflora*
- *Dasyurus maculatus* (Spotted-tailed Quoll)

- *Epacris purpurascens* var. *purpurascens*
- *Eucalyptus camfieldii*
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Haliaeetus leucogaster* (White-bellied Sea Eagle)
- *Heleioporus australiacus* (Giant Burrowing Frog)
- *Hibbertia puberula*
- *Hieraaetus morphnoides* (Little Eagle)
- *Hoplocephalus bungaroides* (Broad-headed Snake)
- *Isoodon obesulus* (Southern Brown Bandicoot)
- *Lasiopetalum joyceae*
- *Lathamus discolor* (Swift Parrot – foraging only)
- *Leptospermum deanei*
- *Lophoictinia isura* (Square-tailed Kite)
- *Melaleuca deanei* (Deane's Paperbark)
- *Microtis angusii* (Angus Onion Orchid)
- *Miniopterus australis* (Little Bentwing Bat)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Persoonia hirsuta* (Hairy Geebung)
- *Petalura gigantea* (Giant Dragonfly)
- *Petaurus australis* (Yellow-bellied Glider)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Petroica boodang* (Flame Robin – foraging only)
- *Phascolarctos cinereus* (Koala)
- *Pimelea curviflora* var. *curviflora*
- *Potorous tridactylus* (Long-nosed Potooroo)
- *Pseudophryne australis* (Red-crowned Toadlet)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Tetratheca glandulosa*
- *Tyto novaehollandiae* (Masked Owl)
- *Tyto tenebricosa* (Sooty Owl)
- *Varanus rosenbergi* (Rosenberg's Goanna).

Prior to this study *Microtis angusii* (Angus's Onion Orchid), which is listed as Endangered under both the BC Act and EPBC Act, was known to occur in the southwestern corner of the Ingleside Precinct in proximity to Mona Vale Road. This was the only known location for this threatened species, but additional records have been provided by Roads and Maritime Services, with locations identified in proximity to Mona Vale Road extending as far east as Ingleside Road. Intensive field survey was undertaken within the original precinct (which included land north of Mona Vale Road) in 2015/16 with

a total of approximately 8,500 individuals from the *Microtis* genus counted. Individuals were classified into species in the field based on morphological characteristics and included *Microtis angusii*. Because the threatened species *Microtis angusii* is difficult to differentiate from other species within the genus, genetic testing subsequent to the field survey was utilised. The genetic testing gave the result that individuals identified from the field surveys as *Microtis unifolia* (a common and widespread species) were identified as *Microtis angusii* based on the genetic analysis.

A further 10 threatened flora species (listed above) were considered as potentially occurring and areas of potential habitat have been mapped, but individuals were not detected during surveys in the appropriate time of year.

Two threatened frogs, Giant Burrowing Frog and Red-crowned Toadlet, are considered likely to occur due to the presence of suitable habitat and records in the Katandra Bushland Sanctuary and Ingleside Chase Reserve to the east. Eastern Pygmy Possum is known to occur with known records in habitat to the north of Powderworks Road. The remaining fauna species listed above are considered as potentially occurring, particularly in areas of habitat within or well connected to areas of continuous habitat throughout the locality. Breeding habitat for Southern Myotis potentially occurs in proximity to drainage lines and dams, and the species has been recorded in the Ingleside Chase Reserve to the east (their foraging habitat is captured under ecosystem credits under BAM). Potential foraging habitat for Regent Honeyeater and Swift Parrot is present, however, this would be for infrequent vagrant individuals with the site unlikely to be of significance as a foraging resource whilst migrating.

# 1. Introduction

## 1.1 Project background

The Ingleside Precinct (referred to in this report as the precinct) is in the Northern Beaches Local Government Area (LGA), with a majority of the Precinct zoned Rural Landscape under Pittwater Local Environment Plan (LEP) 2014. Ownership is a mix of public and private.

The Minister for Planning and the then Pittwater Council (now Northern Beaches Council) have completed extensive studies throughout the Ingleside suburb to identify ecological values either known or likely to present.

## 1.2 Description of the project

The previous planning proposal submitted for the former Ingleside Precinct was intended to result in Biodiversity Certification under the TSC Act. This planning proposal does not propose Biodiversity Certification, however the data and methodology used in this report is based on the former Biodiversity Certification Assessment Methodology. The Rezoning Investigation Area is shown in Figure 1 and is referred to as the precinct throughout this report.

## 1.3 Study area

The Ingleside Precinct (Figure 1) consists of low-density rural dwellings interspersed with open grazing land and dense native vegetation patches. Agricultural and horticultural industries feature within the landscape include quarries, nurseries and golf courses (Monash and Elanora Country Club) located along the southern boundary.

Significant conservation lands are immediately adjacent to the Ingleside Precinct, these include Garigal National Park to the south and Ingleside Chase Reserve to the east (Figure 1).

The plant community types within the Ingleside Precinct are strongly influenced by the topography. Heath vegetation is associated with shallow soils and rocky outcrops and generally occurs at higher elevations within the Precinct (Figure 2).

A large proportion of the Ingleside plateau is cleared semi-rural land with remnants of coastal heath/scrub. These remnants are characterised by a high diversity of flowering shrubs dominated by proteaceous species (ICF and AM 1994). There are also extensive stands of natural and secondary regrowth bushland containing flora and fauna habitats, particularly along the ridgelines and creek lines (Pittwater Council 2008).

Most of the vegetation across the site was burnt during the January 1994 bushfires (Ingleside Landcare 2006). Since this time there has been other smaller fire activity throughout the precinct. Weed invasion is quite heavy in areas where native vegetation has been cleared or disturbed, including along roadsides and most of the watercourses. There is also evidence of weed invasion caused by dumping and escapees from private gardens. Major weeds include Pampas Grass (*Cortaderia selloana*), Crofton Weed (*Ageratina adenophora*), Lantana (*Lantana camara*) and West Australian Wattle (*Acacia saligna*) (Ingleside Landcare 2006).

The site occurs on Hawkesbury Sandstone with minor shale and laminite lenses. Five different soil landscape types occur across the site (Chapman and Murphy 1989, Figure 3). These are described briefly below:

- Oxford Falls soil landscape consists of hanging valleys on Hawkesbury Sandstone with low eucalypt woodland, scrub, heathland and sedgeland. Soils include moderately deep to deep earthy sands, yellow earths and siliceous sands on slopes; deep leached sands, podzols and grey earths on valley floors.
- Hawkesbury soil landscape features rugged, rolling to very steep hills on Hawkesbury Sandstone with >50% rock outcrops. Vegetation is mostly uncleared eucalypt open-woodland and tall open-forest. Soils are shallow lithosols/siliceous sands associated with rock outcrops; earthy sands, yellow earths and some yellow podzolic soils on inside of benches; localised yellow and red podzolic soils associated with shale lenses; siliceous sands and secondary yellow earths along drainage lines.
- Lambert soil landscape features undulating to rolling hills on Hawkesbury Sandstone, occurring on exposed plateau surfaces, convex ridges and coastal headlands of the Hornsby Plateau. Vegetation consists of open and closed-heathland, scrub and occasional low eucalypt open-woodland. Soils include shallow earthy sands and yellow earths, shallow siliceous sands/lithosols; shallow to moderately deep leached sands, grey earths and gleyed podzolic soils in poorly drained areas; localised yellow podzolic soils associated with shale lenses.
- Somersby soil landscape is characterised by gentle undulations to rolling rises on deeply weathered Hawkesbury Sandstone plateau. Vegetation is extensively cleared, low eucalypt open-woodland and scrubland. Soils include red and yellow earths overlying laterite gravels and clays on crests and upper slopes; yellow earths and earthy sands on mid slopes; grey earths, leached sands and siliceous sands on lower slopes and drainage lines, gleyed podzolic soils in low lying poorly drained areas.
- Gymea soil landscape features undulating to rolling rises and low hills on Hawkesbury Sandstone with extensively cleared open-forest and eucalypt woodland. Soils are shallow to moderately deep yellow earths and earthy sands on crests and inside of benches; shallow siliceous sands on leading edges of benches; localised gleyed podzolic soils and yellow podzolic soils on shale lenses; shallow to moderately deep siliceous sands and leached sands along drainage lines.

The soils of the Ingleside area are prone to erosion and landslip (Pittwater Council, 2008). Sources of erosion include unstabilised driveways and tracks on steep slopes, removal of vegetation and dumping of landfill (Ingleside Landcare, 2006).

## 1.4 Scope of works

Eco Logical Australia was engaged by Cox on behalf of DPIE to consider the ecological values across the Ingleside Precinct. This document presents the results of field survey data and information on biodiversity values, as well as the amount of native vegetation present within zones proposed in the Draft Structure Plan. The objectives of this report are to:

- identify biodiversity values within the Ingleside Precinct
- describe the outcomes of the Masterplan in relation to biodiversity values; and
- propose conservation measures


**Figure 1: Location of the Precinct**

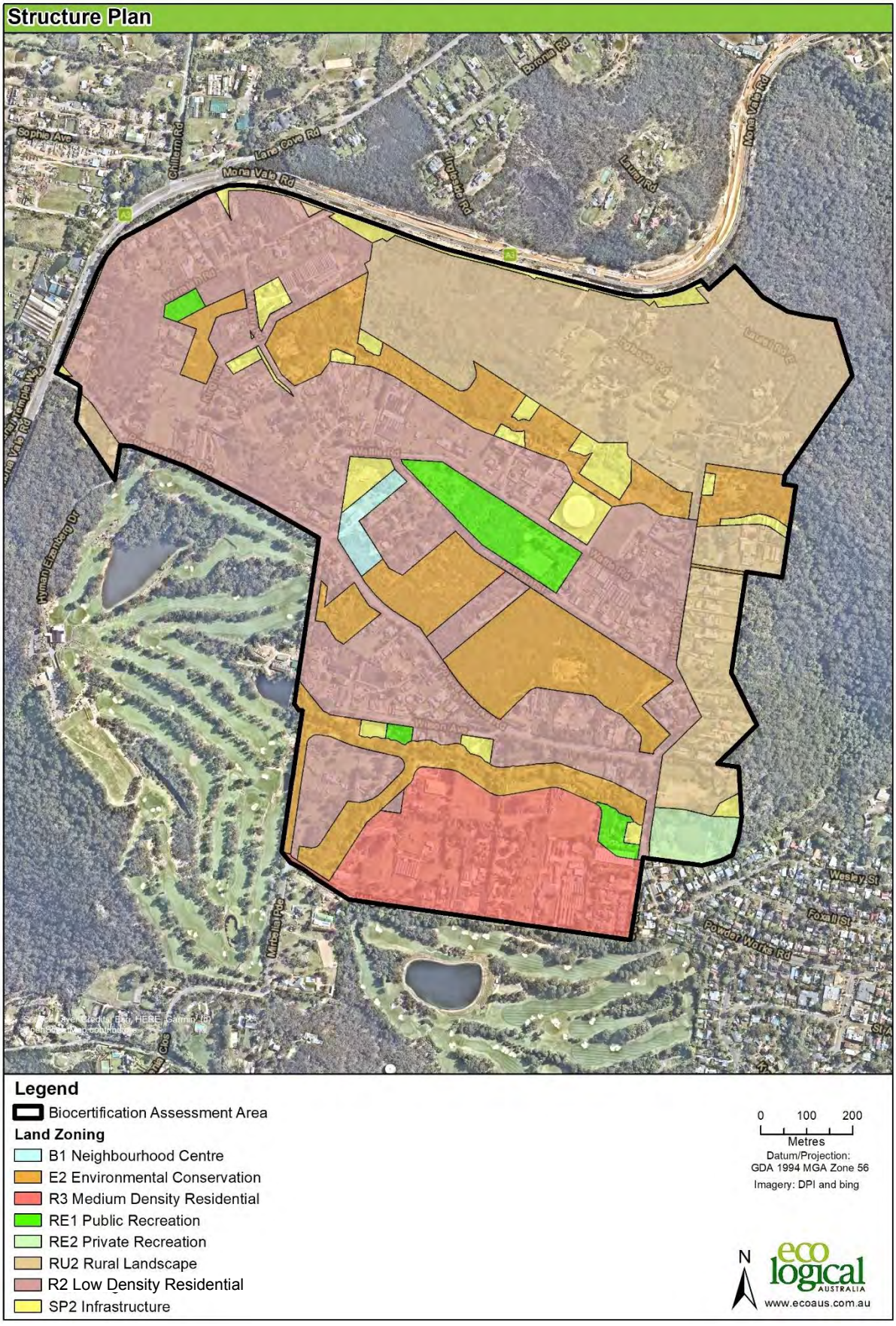


**Figure 2: Proposed Structure Plan**

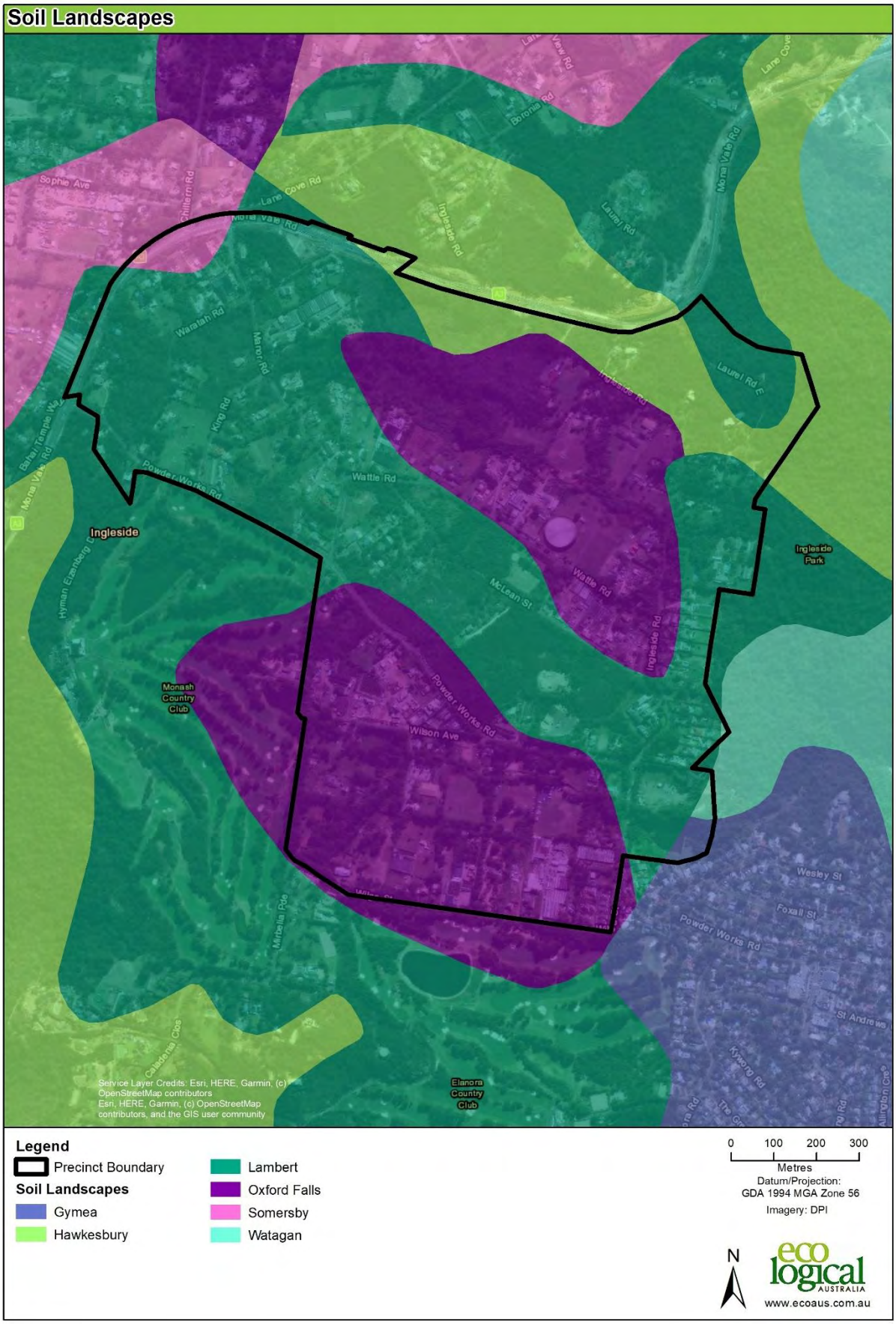


**Figure 3: Soil landscapes in the precinct**

# 2. Legislative context

| Name | Relevance to the project | Section in this report |
|---|---|---|
| Commonwealth | | |
| *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) | The EPBC Act aims to protect Matters of National Environmental Significance (MNES) including wetlands of international importance, threatened species and communities and listed migratory species. An action that may or is likely to have a significant impact on MNES should be referred to the Commonwealth to determine whether it is a Controlled Action that requires approval from the Commonwealth.<br>MNES have been identified on or near the site. This report determines which EPBC Act listed MNES are likely to occur and may require survey at the DA stage. | Section 4 |
| State | | |
| *Environmental Planning and Assessment Act 1979* (EP&A Act) | The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals.<br>The planning proposal will be submitted for Gateway Determination under s56 of the EP&A Act. | Entire report |
| *Biodiversity Conservation Act 2016* (BC Act) | The purpose of the BC Act is to maintain a healthy and productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.<br>Development that has a significant impact on biodiversity values as set out in Part 7 of the BC Act and Part 7 of the Biodiversity Conservation Regulation 2017 are required to undertake an assessment in accordance with the Biodiversity Assessment Method (BAM) and submit a Biodiversity Development Assessment Report (BDAR). The BC Act listed threatened species either known or likely to occur are provided in this report. | Section 4 |
| *Fisheries Management Act 1994* (FM Act) | The objects of the FM Act are to conserve, develop and share the fishery resources of the State for the benefits of present and future generations. The Act provides protection and approval processes for activities which may impact on threatened species, protected marine vegetation or involve dredging, reclamation or obstruction of fish passage.<br>The proposal is not on Key Fish Habitat, or does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage, therefore, a permit or consultation under the FM Act is not required.<br>Note: Bio-certification of the Growth centres does not apply to the FM Act therefore, suitable assessment under the EP&A Act is required and Part 7 FM Act authorisation may be required. | N/A |

# 3. Methodology

## 3.1 Literature and data review

The following literature and data sources were reviewed prior to the commencement of field survey:

- BioNet Atlas of NSW Wildlife (5 km search radius)
- EPBC Act Protected Matters Search Tool
- Biodiversity Assessment Method (BAM 2020)
- Smith and Smith 2000 Survey of the Duffys Forest Vegetation Community
- ELA 2008a Ingleside Land Release – biodiversity
- ELA 2008b Revised corridors and Sandstone Rocky Heath DECC advice
- ELA 2010a Ingleside Land Release Area – integrated corridor layout
- ELA 2010b Ingleside Chase Reserve – Plan of Management (PoM)
- ELA 2011 Review of Provisionally listed EEC
- Eco Logical Australia 2016. *Ingleside Biodiversity Certification: Draft Biodiversity Assessment Report*. Prepared for Department of Planning and Environment.'
- OEH 2013a Updated CMA vegetation mapping.

These sources were reviewed to inform the initial survey requirements. Consideration of the ELA 2016 report was given in the context of the new BAM 2020 and potential threatened species lists were adjusted where required. The BAM threatened flora survey guideline states the following with respect to previous survey effort:

> *"If a species survey has been undertaken on the subject land within five years of the current proposal lodgement date, and the survey meets the requirements of the BAM and this survey guide, these results can be used in place of further on-site survey"*.

Survey effort > 5 years old has also been described in this report.

## 3.2 Vegetation mapping and condition assessment

Comparison of three vegetation mapping datasets (ELA 2008, Pittwater Council 2011, and OEH 2013) was undertaken. ELA (2008) vegetation mapping was a combination of desktop datasets, and two days of field validation by two ELA botanists on public lands. It included a broad condition category assessment, and the vegetation types were correlated to biometric vegetation types.

Vegetation mapping and corridor mapping produced for Pittwater Council (2011) was provided in GIS format and had finer scale mapping, with some limited ground-truthing of private property. The Pittwater Council mapping identified much of the vegetation within the Ingleside Precinct as altered/disturbed. The mapping did not provide a correlation to plant community types and did not include a condition category assessment. Mapping of potential corridors included intact and fragmented vegetation within private and public lands. Corridors linked internal fragmented habitats with conservation areas outside the Precinct.

The latest vegetation mapping for Sydney Metropolitan Catchment Management Authority (SMCMA, OEH 2013) had detailed mapping incorporating small scale changes in the landscape and vegetation type which was used as a base layer.

Prior to field validation, ELA carried out desktop aerial photograph interpretation of all the digital vegetation datasets using high resolution aerial photography at a scale of 1:5,000 (provided by Council). Some areas of mapped vegetation patches were reclassified based on aerial interpretation, and new areas were assigned a preliminary identification of "potential remnant", "unknown" or "exotic/native plantings", which resulted in another approximately 5.5 ha of mapped vegetation. These additional categories were then classified as either a biometric vegetation type (which have since been converted to plant community types) or as exotic during field validation. The exotic classification included native non-indigenous plantings within private gardens and other landscaped areas.

Following agency consultation further investigations were undertaken in March and April 2016 which targeted areas potentially supporting the Coastal Upland Swamp EEC (PCT 978). The time since fire is a particularly important factor to identify and delineate the occurrence of Coastal Upland Swamp EEC. This is because with increased time since fire, Coastal Upland Swamps commonly form dense thickets dominated by obligate seeders (species which are killed by fire). In this state dense thickets of shrubs can form. These shrubs, such as *Banksia ericifolia*, which is found in the Coastal Upland Swamp EEC at Ingleside, are part of the community. However, this species also occurs, and is dominant in, adjoining PCT 882 (Coastal Sandstone Heath-Mallee) and PCT 882 (Coastal Sandstone Rock Plate Heath) vegetation. In addition, when Coastal Upland Swamp EEC occurs in a dense shrub thicket state, the sedge and smaller shrub layers, which are indicative of the Coastal Upland Swamp EEC, become less diverse and much sparser in cover. Thus, identification of the location and extent of Coastal Upland Swamp EEC is difficult if it is a long time since fire.

Some areas were identified by the former Pittwater Council for further investigation, for sites containing potential Coastal Upland Swamp EEC. These sites were revisited in March 2016. At the time of the initial field validation of vegetation types (December 2013/January 2014), most of the vegetation within the Precinct showed no evidence of having been burnt since the bushfires in January 1994. When further investigations were undertaken in March 2016 on the Council identified sites, there had been some recent bushfires (<1 year prior) which allowed additional areas of Coastal Upland Swamp EEC to be identified.

Subsequent to this fieldwork, the occurrence of Coastal Upland Swamps across the Precinct was reviewed. Locations where Coastal Upland Swamps could potentially occur were determined through a combination of aerial photograph interpretation, consideration of the topography, and the extent of field validation which had already been undertaken within specific locations. This work was undertaken by ecologist Brian Towle, who has extensive experience in the identification of Upland Swamps. Areas which were considered to potentially support Coastal Upland Swamps were mapped (Figure 11). Each polygon was also assigned a confidence level which represented the overall likelihood of Coastal Upland Swamp occurring (Very likely, Uncertain, and Unlikely) based upon aerial photo interpretation, topography and level of survey already conducted within the area. The areas of identified potential Coastal Upland Swamps were then validated through a targeted field survey.

A rapid assessment was completed by ELA ecologist Alex Gorey in November 2020 to determine whether there had been any significant change in vegetation community since the above field survey. Vegetation was observed from public roads and Ingleside Chase (Figure 5).

## 3.3 Threatened species

### 3.3.1 Literature and data searches

Appendix A of this report lists the threatened flora and fauna species identified by the database searches as potentially occurring within a 5 km radius of the precinct. The potential occurrence of threatened species was also assessed using the BCAM and then again using the BAM, and these details are supplied in Appendix A.

### 3.3.2 Field survey

### 3.3.3 Threatened flora

Targeted surveys were conducted for previously recorded (based on the 2015 BioNet search) threatened flora species using the random meander technique in 2014 and 2015. Survey was limited to areas of suitable habitat within land with permitted access. There is a chance that there are additional areas of suitable habitat on land that was not accessible.

Targeted surveys within the suitable survey period for *Microtis angusii* and *Tetratheca glandulosa* were conducted in late September and early October in 2015. *Microtis angusii* is known to flower between August and October and was confirmed to be flowering based on inspections of known sites both within and outside the precinct. *Tetratheca glandulosa* is known to flower between July and November. Thus, the survey period coincided with the peak flowering period for both species. The threatened species surveys concentrated efforts in areas identified as higher potential habitat for *Microtis angusii*. However, surveys were also conducted in areas of lower potential habitat for this species. These areas of lower potential habitat coincided with intact native vegetation and represented potential for *Tetratheca glandulosa* habitat.

It is noted that some survey effort targeting *Microtis angusii* occurred outside of the Ingleside Precinct, due to new information on this species and seeking to ascertain if the species occurred across a wider distribution than previously known. Similarly, survey effort targeting *Tetratheca glandulosa* occurred outside of the Ingleside Precinct in areas identified as potential offset sites.

*Microtis angusii* is hard to differentiate from other *Microtis* species based on morphological characteristics. Genetic testing to differentiate *Microtis* species has been developed by the Royal Botanic Gardens. Thus, small leaf samples were taken from *Microtis* specimens and analysed to determine whether they were *Microtis angusii*.

### 3.3.4 Threatened fauna habitat assessment

All accessed vegetation zones were assessed for potential habitat for the candidate threatened fauna species. Potential habitat features were recorded, such as the presence of termite mounds, dams, hollow-bearing trees (HBT's), and presence of abundant foraging resources for Eastern Pygmy Possum (EPP). Field assessments were also conducted along drainage lines and adjacent sandstone and ridgetop

vegetation to validate habitat presence for Giant Burrowing Frog (GBF, *Heleioporus australiacus*) Red-crowned Toadlet (RCT, *Pseudophryne australis*), and Southern Myotis (*Myotis macropus*).

Areas of potential habitat were created for threatened flora and fauna species (species credit species or dual credit species only). This was done using past records, known population locations, existing information on the species' habitat requirements, targeted survey for threated flora species, and habitat field survey for fauna species as per Appendix B.

The field survey effort for undertaking both the vegetation validation and condition assessment and the threatened species habitat assessment are detailed in Table 1. Note, Table 1 describes survey effort across the entire former Ingleside Precinct.

The list of potential threatened fauna species considered likely to occur was revised based on the BioNet and PMST search results from 2020. No targeted survey or on-ground habitat assessment was completed for these species. The habitat assessment was based on a desktop assessment using information available for the site and the species' ecology.

**Table 1: Field survey tasks and effort across the former Ingleside Precinct (north and south of Mona Vale Rd)**

| Date | Total Person Hours | Tasks |
|---|---|---|
| 2/12/2013 | 20 | |
| 4/12/2013 | 20 | |
| 5/12/2013 | 20 | Vegetation type validation<br>Condition assessment<br>Collection of transect and plot data<br>Targeted flora survey<br>Fauna habitat assessment |
| 6/12/2013 | 20 | |
| 10/12/2013 | 20 | |
| 11/12/2013 | 20 | |
| 12/12/2013 | 20 | |
| 13/12/2013 | 20 | |
| 7/01/2014 | 20 | Collection of transect and plot data<br>Targeted threatened flora survey<br>Fauna habitat assessment along watercourses for Red-crowned Toadlet, Giant Burrowing Frog and Southern Myotis<br>Fauna habitat assessment for Eastern Pygmy Possum of both trapped and non-trapped areas |
| 8/01/2014 | 20 | |
| 9/01/2014 | 20 | |
| 15/01/2014 | 20 | Targeted threatened flora survey<br>Counts for Grevillea caleyi<br>Validation of the Duffys Forest Endangered ecological Community<br>Collection of transect and plot data |
| 16/01/2014 | 24 | |
| 17/01/2014 | 24 | |
| 11/02/2014 | 20 | Vegetation type validation<br>Condition assessment<br>Collection of transect and plot data |
| 12/02/2014 | 20 | |
| 21/09/2015 | 40 | Targeted survey for threatened plants, particularly *Tetratheca glandulosa* and *Microtis angusii* |
| 22/09/2015 | 32 | |
| 23/09/2015 | 24 | |

| Date | Total Person Hours | Tasks |
|---|---|---|
| 24/09/2015 | 32 | |
| 25/09/2015 | 32 | |
| 28/09/2015 | 32 | |
| 29/09/2015 | 32 | |
| 30/09/2015 | 32 | |
| 1/10/2015 | 24 | |
| 2/10/2015 | 10 | |
| 6/10/2015 | 10 | |
| 7/10/2015 | 10 | |
| 8/03/2016 | 7 | Validation of Coastal Upland Swamp EEC |
| 6/04/2016 | 7 | |
| **Total** | **652 hours (across the former larger Ingleside Precinct, including land to the north of Mona Vale Road)** | |

## 3.4 Property access

In situations where access was not provided to private properties or commercial lands, an assessment using four key terms was used to describe how vegetation was validated and these are described in Table 2 (Figure 4).

**Table 2: Summary of the access and no-access lands**

| Term | Criteria |
|---|---|
| Accessible | According to the DP&E mapping provided accessible lands include:<br>Private land holders as per agreement<br>Council lands<br>NSW Department of Primary Industry (except when land was apparently leased i.e. where infrastructure was present)<br>National Park (Garigal)<br>NSW Department of Planning and Environment (except when land was apparently leased i.e. where infrastructure was present)<br>Road verge vegetation<br>Validation of the vegetation was undertaken using random meander, plots, and transects of the vegetation patch. Confidence rating for vegetation mapping in these areas was high. |
| No Access: high visibility | Areas where access was not provided, i.e. private properties which did not provide access or no contact details provided, leased crown lands. Despite the lack of access, vegetation was visible from adjoining lands or road side access. This includes identification of vegetation within the canopy, shrub and ground layer. High visibility assessment includes identification of the flora species to determine the vegetation type, zone and condition. Vegetation types were also assessed using SMCMA base mapping, an assessment of the vegetation within the adjoining land, drainage and topography. Confidence rating for vegetation mapping in these areas was moderate to high. |
| No Access: low visibility | Areas where access was not provided, however, some of the vegetation was visible from adjoining lands or road side. Vegetation types were identified using diagnostic canopy species. |

| Term | Criteria |
|---|---|
| | Previous vegetation mapping by SMCMA (OEH 2013), adjoining lands and the topography were used to support validation of the vegetation. The condition was assessed according to the level of fragmentation, presence of weeds (if visible) and level of disturbance. Confidence rating for vegetation mapping in these areas was low due to the lack of visibility. |
| No access | Lands where access was not provided AND no visibility to determine the vegetation condition. Validation of the vegetation was conducted using aerial interpretation (desktop review), or could not be conducted. Confidence rating for vegetation mapping in these areas was low. |

## 3.5 Survey limitations

While every effort has been made to ensure that the information provided within this report is of the highest quality, there are a number of limitations which should be noted. These limitations include:

- Additional field survey was not conducted for the preparation of this report, and as such all previous survey effort was consistent with the BCAM. There may be further survey requirements in the future to ensure that the method is consistent with the BAM at the DA stage.
- Accessibility was a key limitation. The ability to validate vegetation communities or targeted surveys for threatened flora and fauna species was limited to areas where property owners provided access. There is potential that habitat within land which was not accessed may provide suitable habitat for threatened species and EECs (refer to **section 3.4**).
- Validation of vegetation via aerial photograph interpretation is a subjective process. Confidence levels were used to indicate the accuracy of data. See **Section 3.6**.
- Vegetation mapping for this project included professional judgement as to the original vegetation types for areas of disturbed vegetation, particularly those areas in fragmented or weedy condition. It is noted that due to the high level of disturbance, the classification of the vegetation communities is difficult, and may therefore result in some inaccuracies.
- Both flora and fauna species can be cryptic in their habits, exhibit seasonal migratory patterns or dormancy, therefore making them difficult to detect. To account for limitations in field surveys an assessment on the likelihood of each species to occur within the Precinct was undertaken (Appendix A). Areas of potential habitat used a conservative approach. Additional threatened fauna species that are listed under the BAM may require consideration in the future.
- Fauna species were assessed based on a combination of current knowledge and habitat assessment, and for the purposes of identifying species polygons (for species credit species under BAM) a conservative approach was taken of assuming their presence.
- The vegetation field survey was undertaken using hand-held GPS units, which were used to take GPS point locations of flora and fauna observed in the field. It is noted that these units can have errors in the accuracy of the locations taken of approximately 20m (subject to availability of satellites on the day). Differential GPS units were used for the *Microtis angusii* survey, and errors from these units are usually <1m.

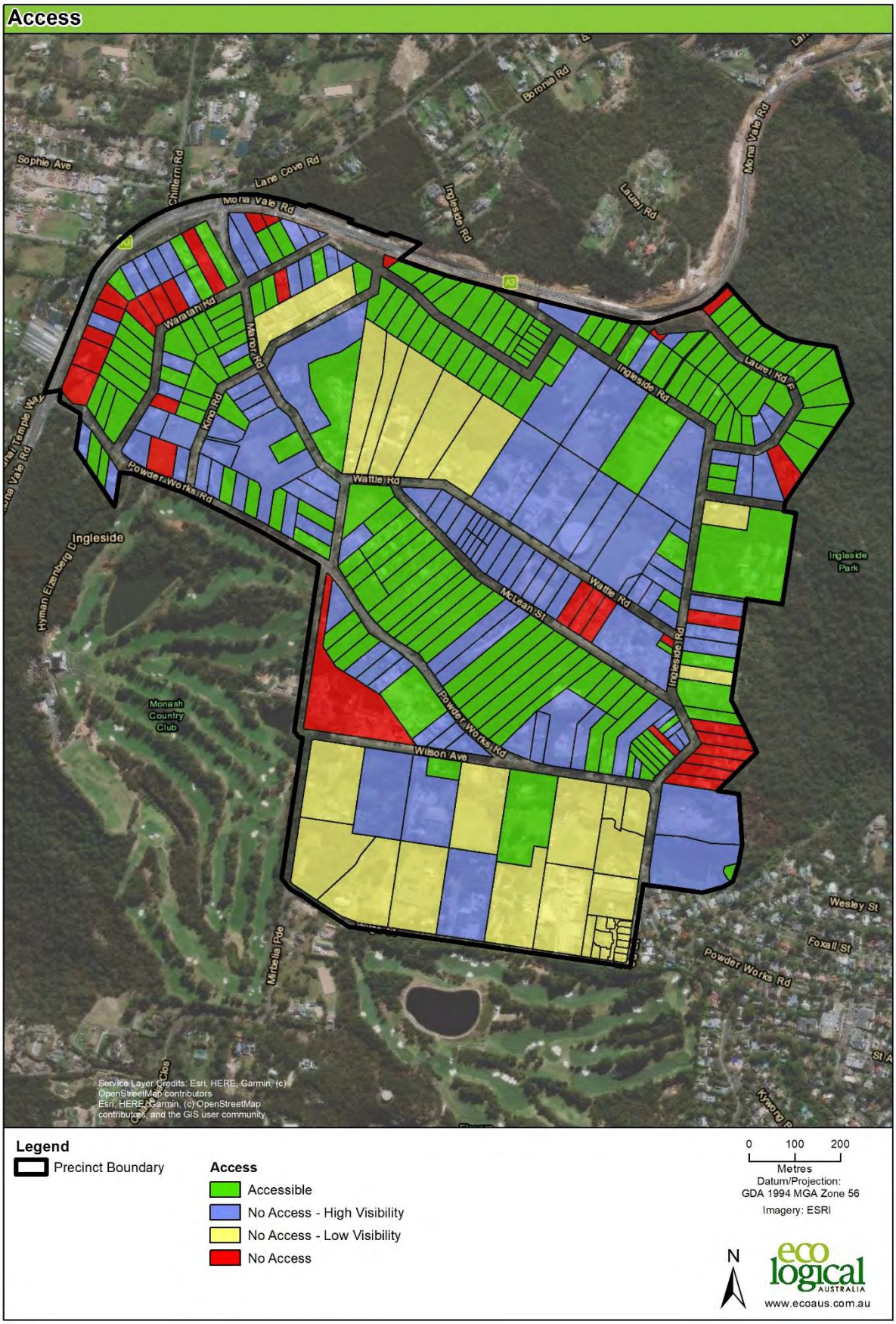


**Figure 4: Level of access across the precinct for the 2015 and 2016 field surveys**


**Figure 5: Areas accessed during 2020 rapid site inspection. Note access was limited to existing roads or public walking trails**

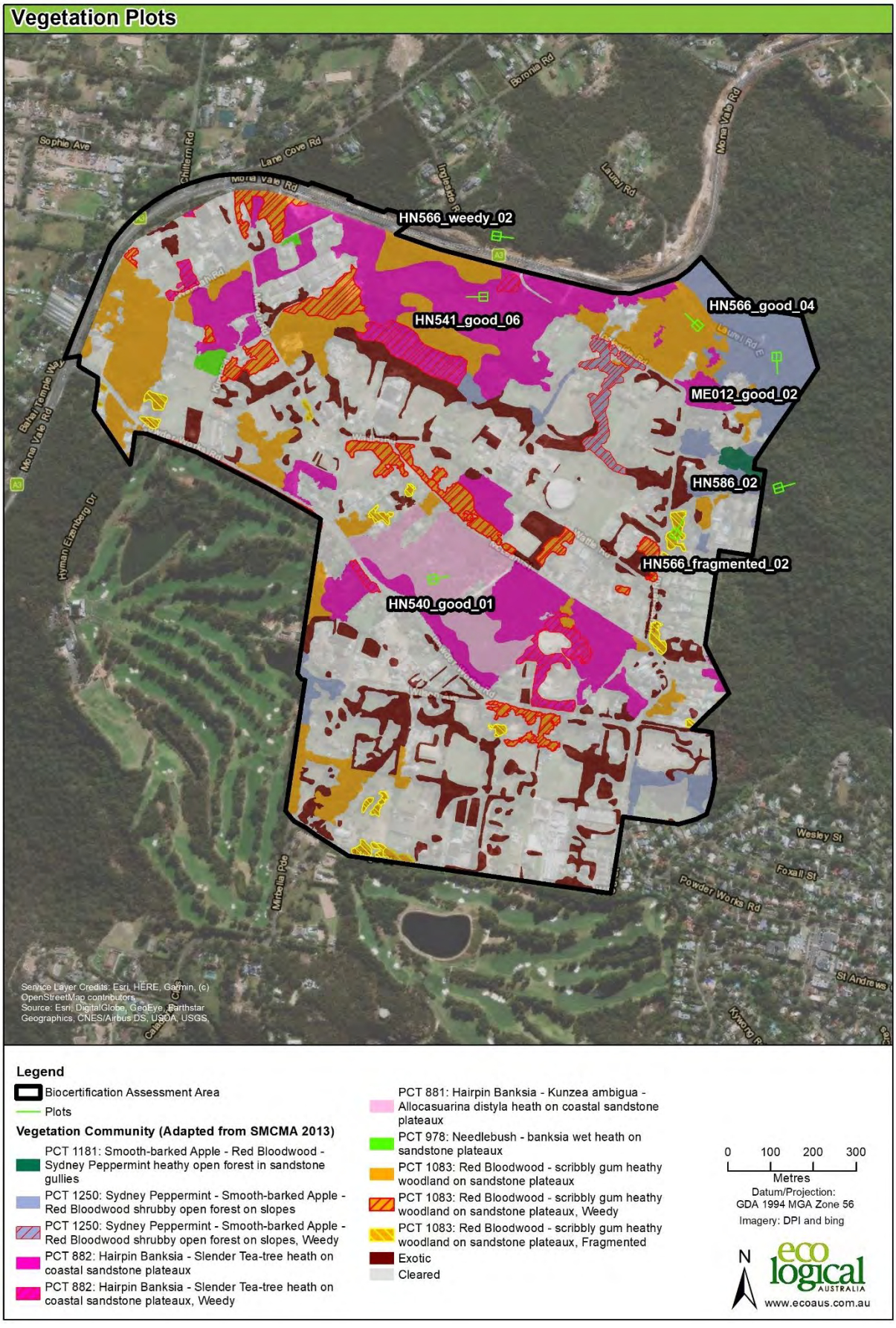


**Figure 6: Vegetation plot locations and Plant Community Types**

# 4. Results

## 4.1 Literature and database reviews

The Precinct has been subject to a number of ecological assessments, including validation of vegetation and targeted surveys for threatened species. ELA conducted a review of available resources and database searches prior to field validations. Literature reviewed was either provided by Council, publicly available, or accessed from other sources. The results have been summarised in the table below.

**Table 3: Summary of literature reviewed for the project (sorted by date)**

| Author | Literature Title | Date | General findings |
|---|---|---|---|
| Smith and Smith | Survey of the Duffys Forest Vegetation Community | 2000 | Smith and Smith were contracted to undertake detailed investigation of the floristic and abiotic characteristics of Duffys Forest and compare with similar adjoining vegetation types. A quantitative analysis tool on the identification of Duffys Forest was the outcome of this report. This methodology was used during field validations. |
| ELA | Ingleside Land Release – biodiversity | 2008a | Initial biodiversity assessment of the Ingleside Land Release Area (note that the assessment boundary differs from the 2013 precinct and the 2008 study did not have access to private lands). This report identified one EEC (Duffys Forest) and potential habitat for threatened species. |
| ELA | Revised corridors and Sandstone Rocky Heath DECC advice | 2008b | Sandstone Rocky Heath vegetation community was identified by ELA as a regionally significant vegetation community as it provides habitat for threatened species, although it is well represented in the adjacent National Parks. Wildlife corridors were revised to include linkages with conservation areas. |
| ELA | Ingleside Land Release Area – integrated corridor layout | 2010a | Update of potential wildlife corridors and protection of significant vegetation and habitats within the Ingleside Land Release Area (refer to **section 5.3**) |
| ELA | Ingleside Chase Reserve – Plan of Management (PoM) | 2010b | Ingleside Chase Reserve borders the north-eastern boundary of the former BCAA precinct. It provides suitable habitat for threatened flora and fauna species. Development within the precinct adjoining this Reserve should consider the priority actions and management recommendations for the Reserve. |
| ELA | Review of Provisionally listed EEC | 2011 | ELA conducted a technical report identifying the potential presence of Hanging Swamp (Coastal Upland Swamp) within the precinct. The report was amended after the ELA 2008a survey following the nomination of this vegetation community as an EEC. |
| ELA | Biodiversity Certification Assessment Report | 2016 | ELA prepared a BCAR for submission with the former Ingleside Precinct that extended to the north of Mona Vale road. This included detail regarding threatened species searches, habitat mapping and connectivity throughout the landscape |
| OEH | Updated CMA vegetation mapping | 2013a | The extent of the Sydney Metropolitan CMA mapping was extended to the north to cover part of the Hawkesbury Nepean CMA. This vegetation map dataset covers the entire Ingleside Precinct and provides a fine-scale (~1:4,000) composite vegetation map for the entire area. Part 2 of the technical report provides detailed community profiles for each vegetation type. The work also provides details on relationships to current and proposed Biometric vegetation types. |

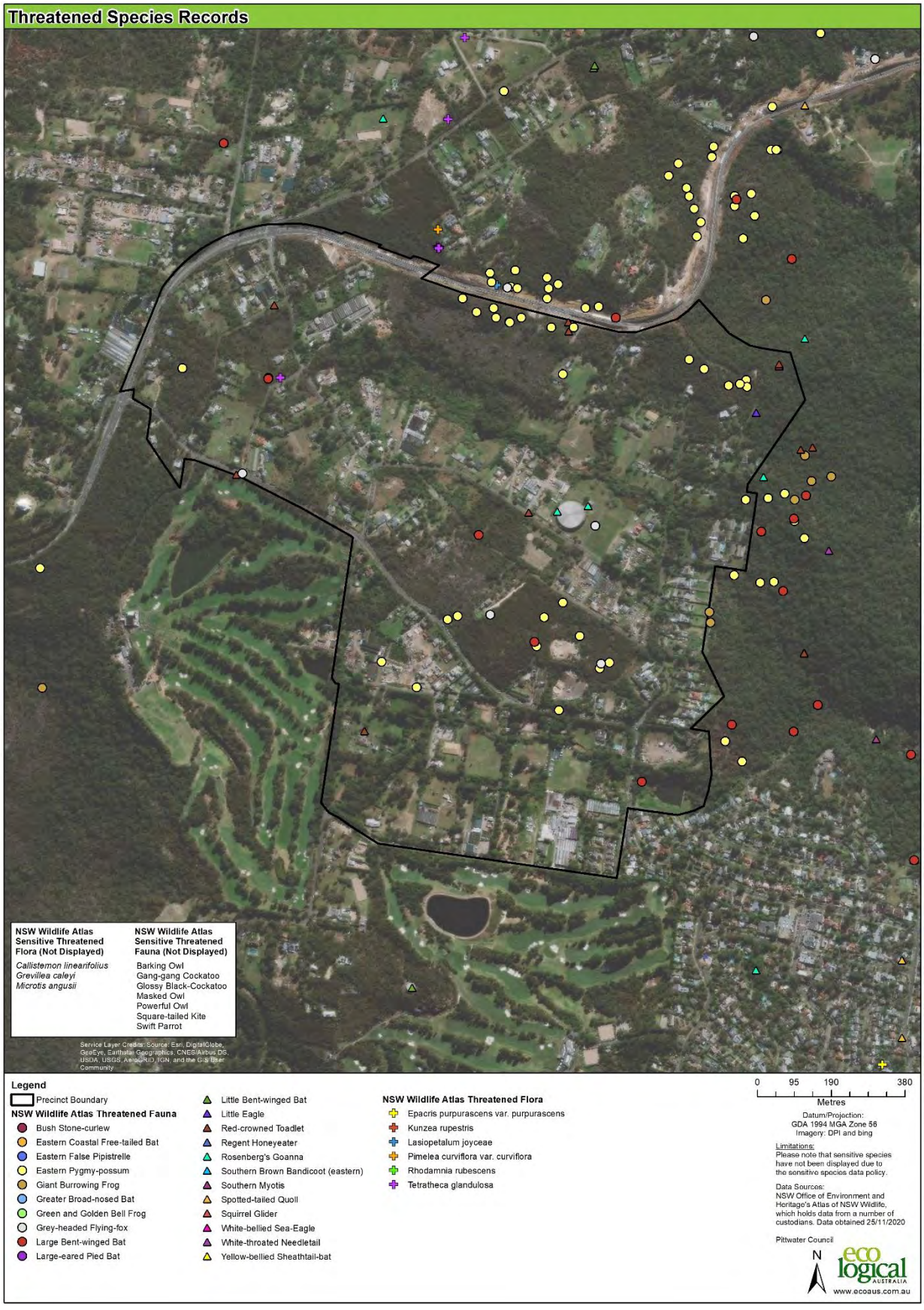


**Figure 7: Threatened flora and fauna species recorded in proximity to the precinct (excluding orchids)**

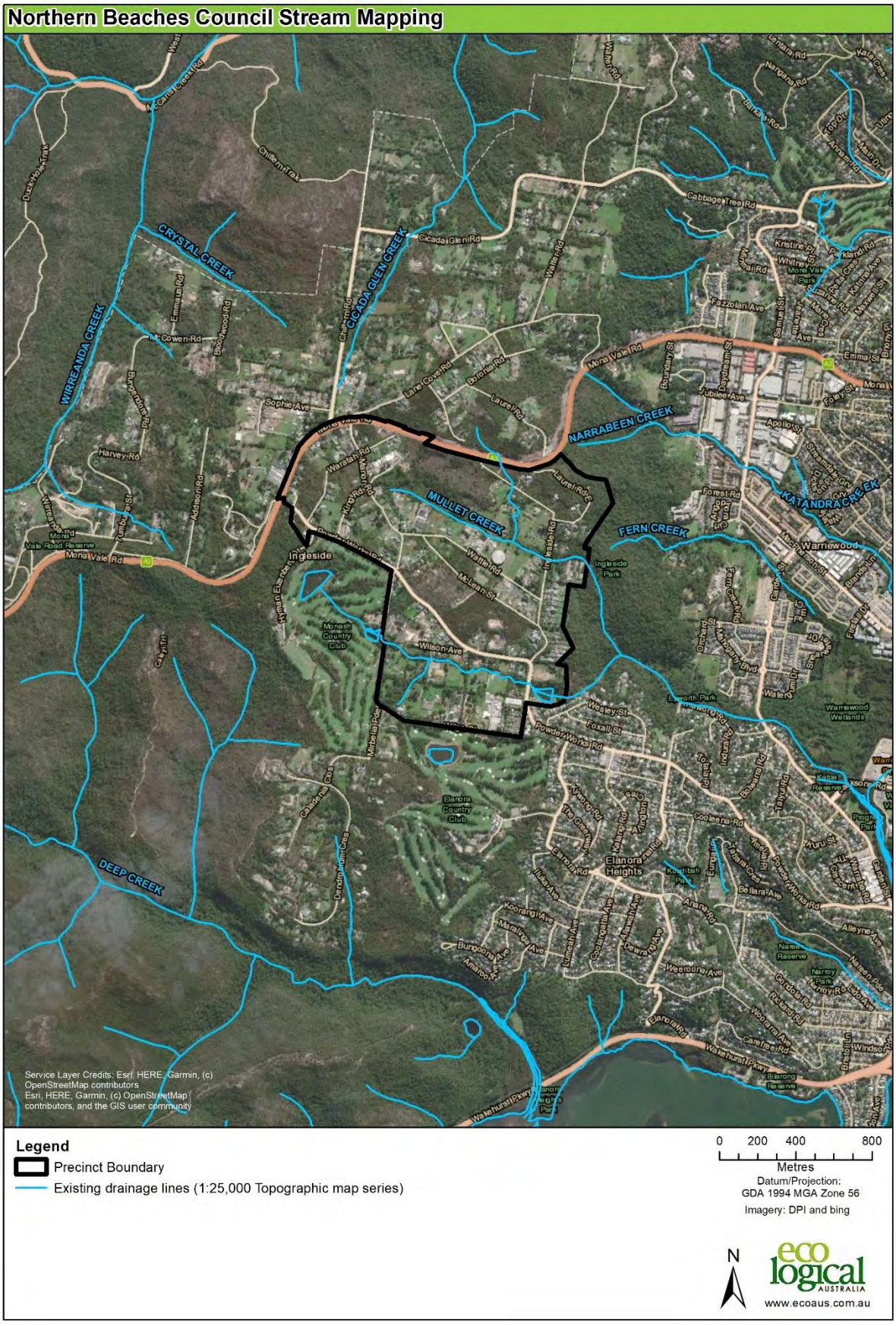


**Figure 8: Previously mapped streams in the precinct**

## 4.2 Vegetation communities

The SMCMA (OEH 2013) vegetation mapping data layer, containing linework that was updated via GIS analysis and through ELA's use of recent aerial imagery, was utilised as a base map for the ecological field surveys.

Although the SMCMA vegetation community mapping was relatively accurate, being a broad-scale map dataset there were areas of inaccuracies relating to an incorrect vegetation community classification or mapped extent. After field surveys were undertaken, the digital vegetation dataset derived from the desktop mapping exercise was updated, and classifications of vegetation communities amended where they were found to differ during validation. The boundaries of some vegetation community polygons were also realigned during these updates at a scale of 1:4,000. Further refinement of vegetation mapping occurred as a result of further validation for Coastal Upland Swamp EEC (see **section 3.2.4** for details).

### 4.2.1 SMCMA (2013) Vegetation Communities

A detailed description of the seven SMCMA vegetation communities and their associated PCTs is provided in **Section 4.2.3**. The field validation confirmed six SMCMA (OEH 2013) vegetation community types, as well as exotic vegetation being present within the Precinct. One vegetation community / PCT validated in the precinct conform to one endangered ecological community under the BC Act and EPBC Act; Coastal Upland Swamps (**Table 4**).

**Table 4: Endangered Ecological Communities in the Precinct**

| SMCMA Vegetation Community | BC Act listing | EPBC Act |
|---|---|---|
| Coastal Upland Damp Heath Swamp | Endangered - Coastal Upland Swamps in the Sydney Basin Bioregion | Endangered - Coastal Upland Swamps in the Sydney Basin Bioregion |

### 4.2.2 Plant community types (PCTs)

The SMCMA (OEH 2013) vegetation communities were matched with the equivalent biometric vegetation type and then to plant community type. The report accompanying the SMCMA (OEH 2013) mapping vegetation had already identified a corresponding biometric vegetation type in the vegetation community descriptions. These were then assigned to the best fit PCT based on geography, topography and species composition. These are identified in **Table 5**.

Where PCTs were in weedy condition they were separated out as a different zone for each PCT (Figure 10). This is because the species composition and structure of the patch were substantially different to areas of the community in moderate to good condition.

**Table 5: Biometric vegetation type conversions**

| PCT Code | BVT | Vegetation SMCMA (OEH 2013) | EEC and % Cleared |
|---|---|---|---|
| 1181 - Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion | HN586 Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin | Coastal Enriched Sandstone Dry Forest | Not an EEC, 20% |
| 1250 - Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion | ME012 (also HN651) Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin | Coastal Sandstone Gully Forest | Not an EEC, 30% |
| 882 - Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion | HN541 Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin | Coastal Sandstone Heath-Mallee | Not an EEC, 10% |
| 881 - Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion | HN540 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin | Coastal Sandstone Rock Plate Heath | Not an EEC, 21% |
| 978 - Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion | HN560 Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin | Coastal Upland Damp Heath Swamp (note this is a "damp" subcommunity) | Coastal Upland Swamps in the Sydney Basin Bioregion, 48% |
| 1083 - Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion | HN566Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin | Sydney North Exposed Sandstone Woodland | Not an EEC, 17% |

**PCT = Plant Community Type. The code number provided is that assigned in the online Vegetation Information System (VIS). The percent cleared is from VIS as at 1/12/2020.**

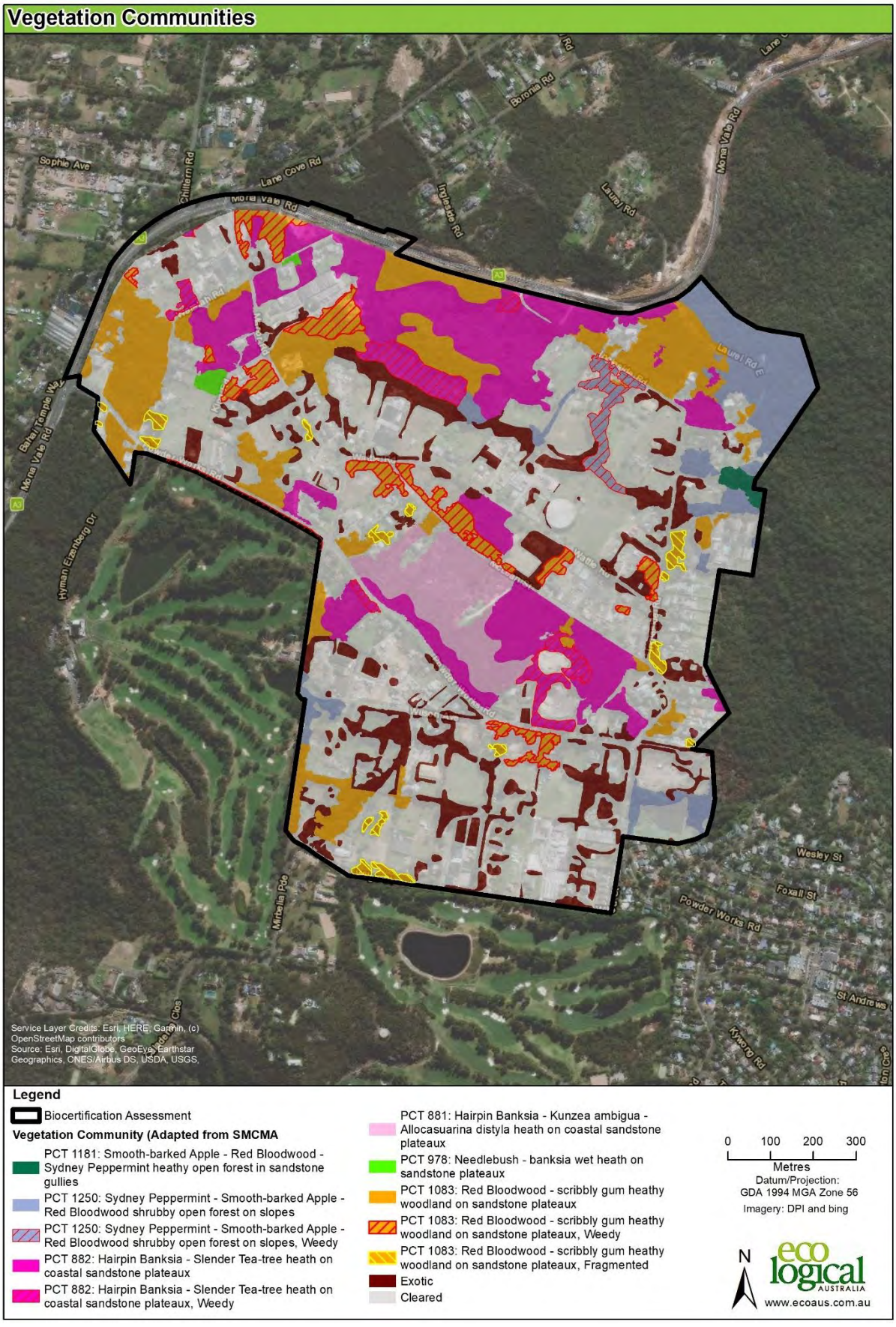


**Figure 9: PCTs adapted from the SMCMA 2013**

### 4.2.3 Vegetation community descriptions

#### *4.2.3.1 PCT 1181 Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion*

This vegetation community is represented as small patches on private lands, which flow into adjacent conservation reserve along the eastern extent of the precinct. There is high species diversity, with very low weed densities.

| **PCT 1181** | **Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion** |
|---|---|
| Associated BVT | HN586 - Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin |
| Associated SMCMA community | Coastal Enriched Sandstone Dry Forest |
| Location | Located on private lands along the eastern boundary adjoining Katandra Bushland Sanctuary. |
| Description | This vegetation type is a tall open forest generally located on upper slopes and dry gullies (OEH 2013). Vegetation is influenced by clay capping over sandstone soils. Vegetation is common on escarpments although it is poorly represented within the Precinct.<br>This community comprises a significant buffer for an adjacent bushland reserve and potential wildlife corridor for threatened species. |
| |  |
| Canopy | This vegetation type has a canopy dominated by *Angophora costata* with *Syncarpia glomulifera, E. piperita* occurring less frequently. |
| Midstorey | Characterised by a tall midstorey of: *Allocasuarina torulosa* and *Notelaea longifolia,*<br>*Elaeocarpus reticulatus, Glochidion ferdinandi* and *Ceratopetalum gummiferum* |
| Groundcovers | The groundcover of this vegetation type is characterised by a number of native species including: *Xanthorrhoea* sp., *Dianella caerulea* var. *producta* and *Entolasia marginata* |
| Weeds | None recorded. |

#### *4.2.3.2 PCT 1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion*

This vegetation community is confined to gullies along formed creek lines and sheltered lower slopes and is extensive in the Precinct. The terrain rapidly fluctuates and contains large remnant trees. The vegetation classified as "good" condition is generally intact and generally forms a continuous corridor with adjacent conservation lands or other vegetation communities within the precinct boundary. Examples of good condition vegetation are located along the headwaters of a number of tributaries and creeks located beyond the confines of the Precinct. This vegetation community also exists as weedy and fragmented condition and is adjacent to disturbed areas such as roads and as scattered remnant trees in urban landscaped gardens.

| **PCT 1250** | **Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion** |
|---|---|
| Associated BVT | ME012 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin |
| Associated SMCMA community | Coastal Sandstone Gully Forest |
| Location | Occurs at the headwaters of creek lines. |
| Description | This vegetation type located on sheltered gullies on infertile soils of the Hawkesbury sandstone. Vegetation consists of sclerophyll species mixing into gully streams often associated with a rocky terrain. |
| |  |
| Canopy | This vegetation type had a canopy dominated by *Angophora costata* and, *Corymbia gummifera, E. piperita.* The presence of *E. piperita* distinguishes this community from adjacent vegetation. *E. punctata* and *E. sieberi* occur less frequently. |
| Midstorey | Characterised by tall shrub layer including: *Banksia serrata, Ceratopetalum gummiferum, Allocasuarina littoralis* or *Callicoma serratifolia.* |

| PCT 1250 | Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion |
|---|---|
| Groundcovers | The groundcover of this vegetation type are characterised by a number of native grasses and sedges including: variety of *Lomandra* sp., *Entolasia stricta*, *Xanthosia* sp., *Lepyrodia scariosa* and *Cyathochaeta diandra*. |
| Weeds | In weedy conditions vegetation includes: Bidens pilosa, Ageratina adenophora, Lantana camara, Senna septemtrionalis and garden escapees Nephrolepis cordifolia. |

#### *4.2.3.3 PCT 882 Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion*

This community is widely distributed within the entire Precinct. It includes large tracts of vegetation and small fragmented patches with most of the vegetation in good condition. There are three conditions mapped for this vegetation community i.e. good condition, weedy, and fragmented condition. Good condition PCT 882 also varies in structure and species composition within the Precinct with examples of tree-less heath communities present in rocky outcrops. Where a canopy is present it is typically mallee or stunted. Weedy condition Coastal Sandstone Heath-Mallee is associated with clearing of vegetation for urban development and includes the outer edges of good condition vegetation. Fragmented vegetation includes remnant trees such as *Eucalyptus haemastoma* with exotic mid and ground layer. These are often featured in urban gardens.

| PCT 882 | Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion |
|---|---|
| Associated BVT | HN541 Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin |
| Associated SMCMA community | Coastal Sandstone Heath-Mallee |
| Location | Widespread throughout the Precinct |
| Description | The vegetation is heath dominated by dense shrub layer. Vegetation is highly diverse with the shrub and ground layers. |

| PCT 882 | Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion |
|---|---|
| Canopy | Canopy consists of mallee form trees or tall shrubs including: *Allocasuarina distyla, Eucalyptus haemastoma, Corymbia gummifera,* and *Eucalyptus oblonga* |
| Midstorey | Highly diverse assemblage of shrubs: *Pultenaea tuberculata, Acacia suaveolens, Darwinia fascicularis, Kunzea ambigua* and variety of *Leptospermum* sp. |
| Groundcovers | The groundcover of this vegetation type is highly diverse assemblage of forbs and sedges and grasses: *Actinotus minor, Platysace linearifolia, Epacris longiflora, E. microphylla, Dampiera stricta* and *Anisopogon avenaceus* |
| Weeds | In weedy condition this vegetation community contained: *Hypochaeris radicata*, *Lantana camara* and *Cortaderia selloana.* |

#### *4.2.3.4 PCT 881 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion*

There are several small patches of PCT 881 scattered within the Precinct. These patches are typically surrounded by other heath vegetation forms in particular HN541 and HN566 and represent a floristically diverse assemblage of species in a small area. A large patch of intact located on the northern side of Powderworks Road is dominated by a dense midstorey of *Allocasuarina distyla*. This vegetation patch when surveyed in December 2013 had remained unburnt for an extended period. Despite the absence of fire, the vegetation within the ground layer remains diverse in this patch.

| PCT 881 | Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion |
|---|---|
| Associated BVT | HN540 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin |
| Associated SMCMA community | Coastal Sandstone Rock Plate Heath |
| Location | Located in the eastern extent of Precinct on higher elevations of shallow soils and exposed rocky outcrops surrounded by heath vegetation. Well represented north side of Powderworks Road. |
| Description | This vegetation type is a sparsely vegetated community on exposed rock plateaus. Shrub layer consists of small heathy patches where at times can form dense patches in long unburnt areas. |

| PCT 881 | Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion |
|---|---|
| |  |
| Canopy | Tree canopy is absent from this community |
| Midstorey | Shrubs include; Kunzea *ambigua and Allocasuarina distyla, Darwinia fascicularis, Epacris microphylla* and *E. longifolia* |
| Groundcovers | The groundcover of this vegetation type was characterised by a number of native sedges and herbs including *Caustis pentandra, Actinotus minor* and *Cyathochaeta diandra* |
| Weeds | None recorded. |

#### *4.2.3.5 PCT 978 Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion*

This PCT conforms to the Coastal Upland Swamp community listed as endangered under both the BC Act and EPBC Act. This vegetation community is highly unique as it is one of two hanging or upland swamp communities recorded within the Sydney region (OEH 2013). The vegetation is located at high elevation up to 600 m above sea level. Water seepage is an important feature for this community as it is a groundwater dependent ecosystem (GDE). As such this community is often located at headwaters of creeks on impeded soils. There are several patches of this community scattered within the Precinct. A large patch is located between Manor Road and Powderworks Road and another large patch which extends outside of the Ingleside Precinct, within the north-western aspect in the grounds utilised by the Ingleside Scouts.

| PCT 978 | Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion |
|---|---|
| Associated BVT | HN560 – Needlebush – banksia wet heath on sandstone plateaux of the Sydney Basin |
| Associated SMCMA community | Coastal Upland Damp Heath Swamp |
| Location | Located along the northern boundary of the Precinct and in small patches on the southern side of Mona Vale Road. |

| PCT 978 | Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion |
|---|---|
| Description | This vegetation type comprises of unique assemblage of sedges and scattered shrubs influenced by the moist seepage at higher elevations. |
| |  |
| Canopy | Trees are absent from within the community, although mallee may fringe the edges |
| Midstorey | Characterised by sclerophyll species: *Banksia ericifolia, B. oblongifolia, Hakea teretifolia and Baeckea imbricata* |
| Groundcovers | The groundcover of this vegetation type was characterised by a number of sedges including: *Empodisma minus*, *Actinotus minor, Cyathochaeta diandra* and *Bauera rubioides.* |
| Weeds | None recorded. |

#### *4.2.3.6 PCT 1083 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion*

This community is the most extensive PCT within the Precinct. It forms low-open eucalypt woodland dominated by heath vegetation (OEH 2013). It is usually associated with shale influence on sandstone ridges in coastal Sydney regions (OEH 2013). Rocky outcrops may be exposed on upper slopes. Weedy patches are located along road verges, urbanised areas and 'edge effect' habitats. Weedy patches contained a canopy of *Eucalyptus haemastoma* in a disturbed environment.

| PCT 1083 | Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion |
|---|---|
| Associated BVT | HN566 - Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin |
| Associated SMCMA community | Sydney North Exposed Sandstone Woodland |
| Location | Widely distributed throughout the entire precinct |
| Description | This vegetation type located on exposed slopes and scattered throughout the precinct |

| PCT 1083 | Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion |
|---|---|
| |  |
| Canopy | This vegetation type had a canopy dominated by *Eucalyptus haemastoma, E. punctata* and *Corymbia gummifera.* |
| Midstorey | Characterised by a variety of species: Lepto*spermum trinervium, Banksia ericifolia, B. serrata, Grevillea buxifolia* and *G. sericea*. |
| Groundcovers | The groundcover of this vegetation type was characterised by a number of species including: *Platysace linearifolia, Xanthosia tridentata, Lepidosperma laterale, Tetratheca ericifolia* and *Dampiera stricta.* |
| Weeds | *Asparagus aethiopicus, Rubus fruticosus* aggregate and *Hydrocotyle bonariensis*. *Eucalyptus saligna* is considered a non-indigenous species to the area and has been planted. |

### 4.2.4 Coastal Upland Swamps

Additional investigations of areas initially mapped as PCT 882 (as discussed in **Section 3.1**), identified additional patches of Coastal Upland Damp Heath Swamp, which forms part of the Coastal Upland Swamps EEC, within the Precinct.

The reclassification of areas initially identified as PCT 882 to PCT 978 was based upon assessment of floristic composition and the interactions of landform and hydrology. Floristically, areas of PCT 882 were distinguished from PCT 978 by the absence or infrequent occurrence of species associated with woodlands, including *Banksia serrata*, *Allocasuarina distyla* and trees including *Eucalyptus* species and *Corymbia gummifera.* PCT 978 generally had an increased cover of *Hakea teretifolia* and *Leptospermum squarrosum* within the shrub layer and a diverse array of sedges and rushes within the understorey, compared to PCT 882.

PCT 882 are associated with increased moisture as a result of low surface gradients, where surface run-off is slow, or on steeper slopes where impermeable sandstone strata causes seepage of moisture where the impermeable sandstone outcrops, termed 'terminal steps'. Within areas of PCT 882, the landforms were such that surface flows were variable across the patch of vegetation, with changes in slope and

aspect occurring over small areas. Surface flows quickly entered defined channels and no terminal steps with seepage were observed.

Three areas were reclassified from PCT 882 to PCT 978 as a result of the additional investigations, and which resulted in the total area of mapped PCT 978 EEC within the Ingleside Precinct mapped as 0.3 ha (Figure 11).

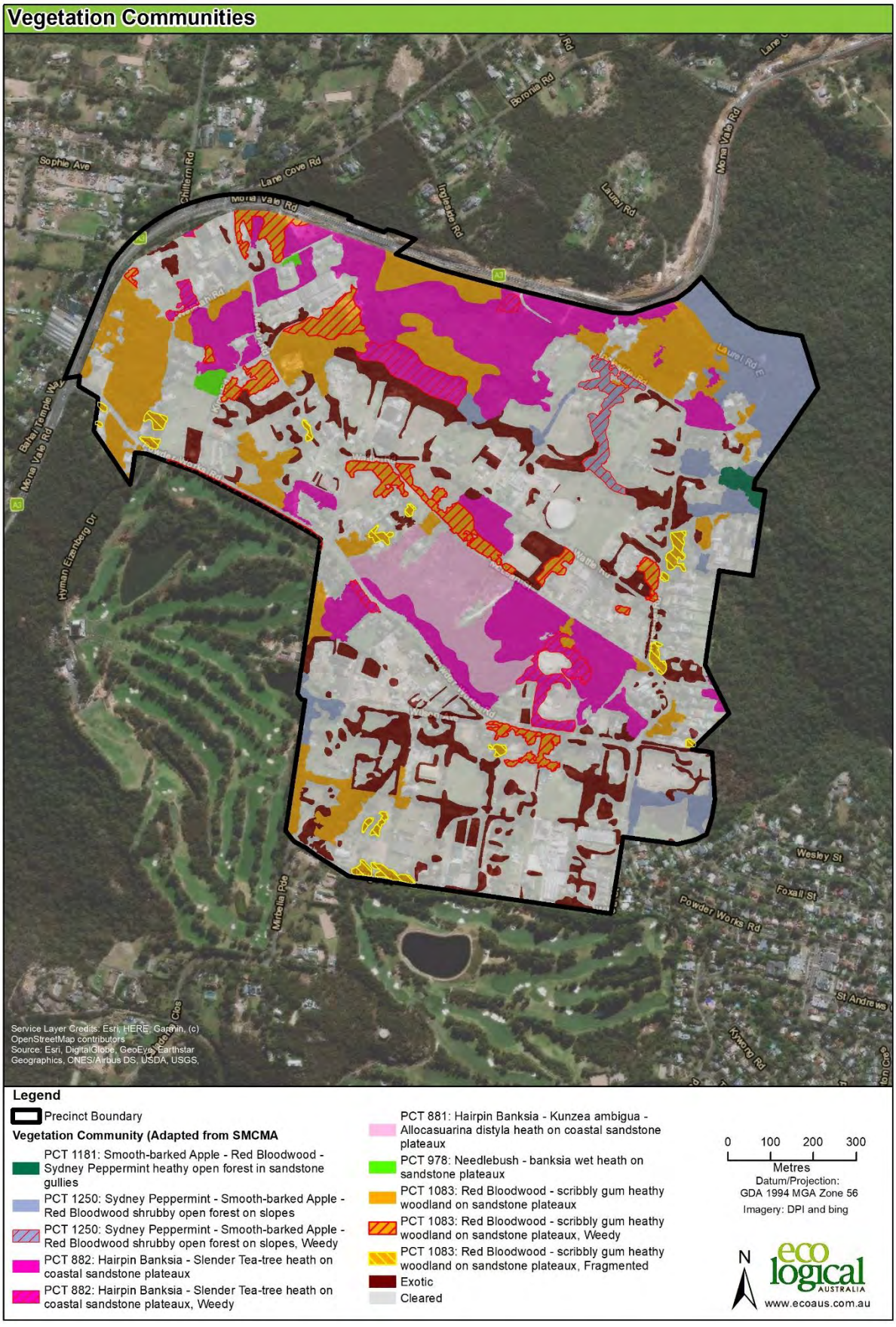


**Figure 10: PCTs in the precinct**

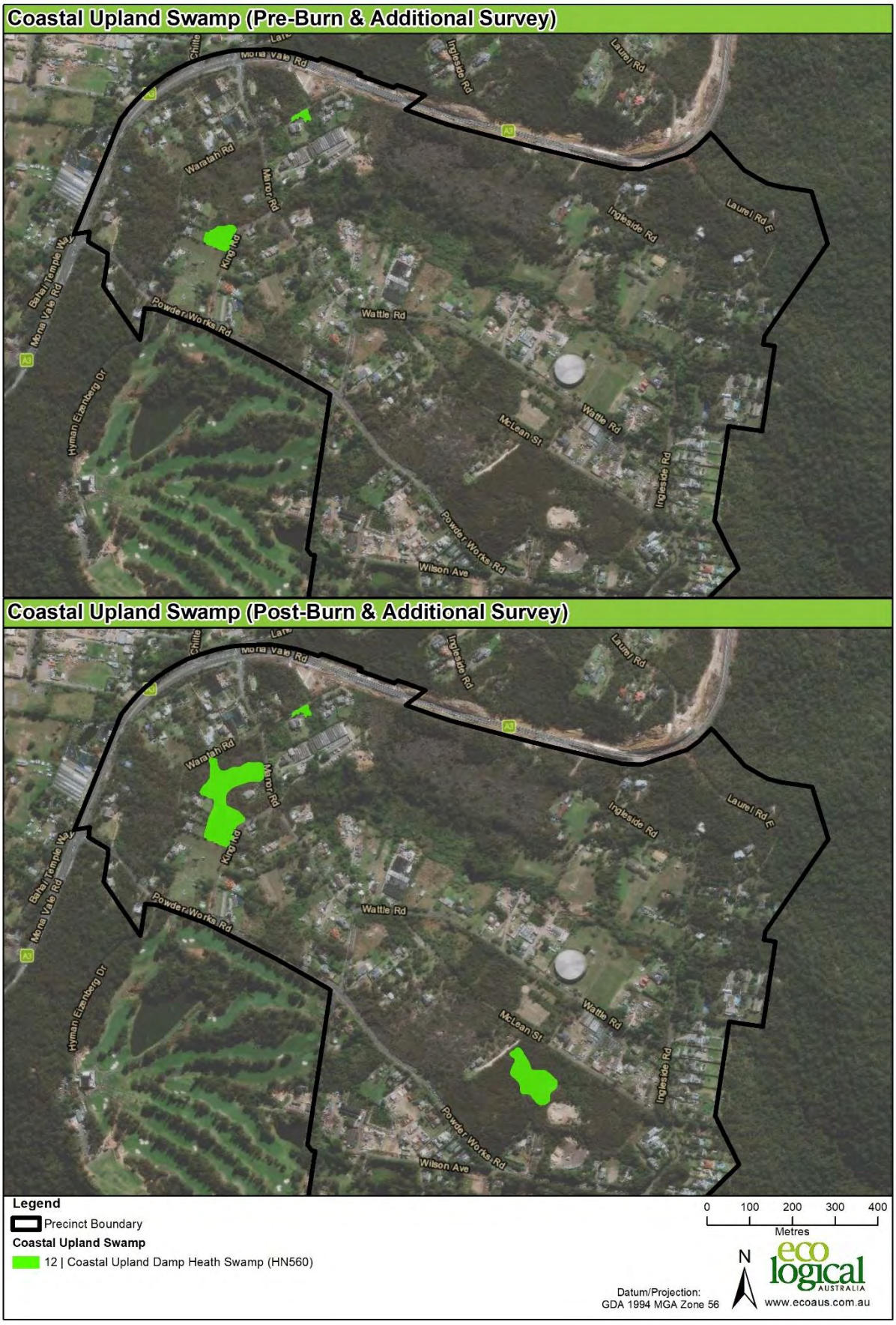


**Figure 11: Coastal Upland Swamp (PCT 978) mapped in the precinct**

## 4.3 Threatened species

Under BAM threatened fauna species are divided into those species that can be predicted by vegetation habitat surrogates (ecosystem credit species), and species that cannot reliably be predicted by habitat surrogates (species credit species). Some threatened species are listed as dual credit species, where their foraging habitat can be predicted by vegetation surrogates, but their breeding habitat is specific and a vegetation surrogate cannot be used. These dual credit species are ecosystem credit species for foraging and species credit species for breeding.

The predicted ecosystem credit species, species credit species and dual credit species are listed in Table 6 and Table 7. Where relevant, if a threatened species is also listed as an MNES under the EPBC Act this has been detailed in Table 6 and Table 7.

### 4.3.1 Threatened fauna – ecosystem credit species

The ecosystem credit species which are predicted in the Precinct are summarised in **Table 6.** Two of these species are also listed as MNES under the EPBC Act.

**Table 6: Ecosystem credit species predicted using criteria**

| Common name | Scientific Name | BC Act listing | EPBC Act listing |
|---|---|---|---|
| Barking Owl (foraging) | *Ninox connivens* | V | - |
| Eastern False Pipistrelle | *Falsistrellus tasmaniensis* | V | - |
| Eastern Free-tailed Bat (added) | *Micronomus norfolkensis* | V | - |
| Gang-gang Cockatoo (foraging) | *Callocephalon fimbriatum* | V | - |
| Glossy Black-cockatoo (foraging) | *Calyptorhynchus lathami* | V | - |
| Greater Broad-nosed Bat | *Scoteanax rueppellii* | V | - |
| Little Bent-wing Bat | *Miniopterus australis* | V | - |
| Little Eagle (foraging) | *Hieraaetus morphnoides* | V | - |
| Little Lorikeet | *Glossopsitta pusilla* | V | - |
| Masked Owl (foraging) | *Tyto novaehollandiae* | V | - |
| Powerful Owl (foraging) | *Ninox strenua* | V | - |
| Scarlet Robin | *Petroica boodang* | V | - |
| Spotted-tailed Quoll | *Dasyurus maculatus* | V | E |
| Squirrel Glider (foraging) | *Petaurus norfolcensis* | V | - |
| Swift Parrot (foraging) | *Lathamus discolor* | E | CE, Ma |
| Yellow-bellied Glider | *Petaurus australis* | V | - |

### 4.3.2 Species credit flora and fauna species under BAM

A total of 34 candidate species credit species were identified (Appendix B), of which 13 are flora species, and 21 are fauna species. Of these, 10 threatened flora species and 19 fauna species are also a listed MNES under the EPBC Act.

These species and their biodiversity risk weightings which are the species sensitivity to loss or sensitivity to potential gain are summarised in **Table 7**. A very high biodiversity risk weighting means that a species cannot withstand loss and is at risk of extinction. These entities are also known as candidates for Serious

and Irreversible Impacts (SAII) under the BAM. The higher the risk weighting the larger offset is required (i.e. the higher the weighting, the larger the offset that is required). Table 7

The Biodiversity Risk Weighting will be relevant to credit calculations, to be performed when development applications are submitted. The credit calculations will be based on the number of individuals impacted for threatened flora species and the area of habitat for threatened fauna species consistent with the BAM.

The methodology also requires that species polygons are mapped for species credit species (for both flora and fauna species). These have been mapped, with some species grouped as they are linked to the same vegetation extent. Appendix B contains details of the approach used to identify and map the areas of potential habitat, and **Table 7** identifies the relevant potential habitat figure for each species. It is noted that mapping of habitat polygons for potential habitat does not mean that the species does occur, this identifies potential habitat only.

**Table 7: Final species credit species and MNES list for Ingleside Precinct**

| Species | Biodiversity risk weighting | SAII candidate | BC Act listing | EPBC Act listing | Potential habitat (Figure #) |
|---|---|---|---|---|---|
| **Flora species** | | | | | |
| *Acacia terminalis* subsp. *terminalis* | High | No | E | E | Figure 12 |
| *Callistemon linearifolius* | Moderate | No | V | - | Figure 13 |
| *Darwinia biflora* | Moderate | No | V | V | Figure 14 |
| *Epacris purpurascens* var. *purpurascens* | Moderate | No | V | - | Figure 15 |
| *Eucalyptus camfieldii* | Moderate | No | V | V | Figure 16 |
| *Hibbertia puberula* | High | No | | - | - |
| *Lasiopetalum joyceae* | Moderate | No | V | V | Figure 17 |
| *Leptospermum deanei* | Moderate | No | V | V | Figure 18 |
| *Melaleuca deanei* | Moderate | No | V | V | Figure 12 |
| *Microtis angusii* | very high | Yes | E | E | sensitive species; locations cannot be released |
| *Persoonia hirsuta* | Very high | Yes | E | E | Figure 19 |
| *Pimelea curviflora* var. *curviflora* | Moderate | No | V | V | Figure 16 |
| *Tetratheca glandulosa* | Moderate | No | V | - | Figure 12 |
| **Fauna Species** | | | | | |
| *Callocephalon fimbriatum* (Gang-gang Cockatoo) breeding | Moderate | No | V | - | Figure 20 |

| Species | Biodiversity risk weighting | SAII candidate | BC Act listing | EPBC Act listing | Potential habitat (Figure #) |
|---|---|---|---|---|---|
| *Calyptorhynchus lathami* (Glossy Black Cockatoo) breeding | Moderate | No | V | - | Figure 20 |
| *Chalinolobus dwyeri* (Large-eared Pied Bat) breeding | Moderate | Yes | V | V | Figure 21 |
| *Haliaeetus leucogaster* (White-bellied Sea Eagle) | Moderate | No | V | Mar | Figure 24 |
| *Hoplocephalus bungaroides* (Broad-headed Snake) | High | No | E | V | Figure 25 |
| *Hieraaetus morphnoides* (Little Eagle) breeding | Moderate | No | V | - | Figure 24 |
| *Lophoictinia isura* (Square-tailed Kite | Moderate | No | V | - | Figure 29 |
| *Ninox connivens* (Barking Owl) breeding | Moderate | No | V | - | Figure 30 |
| *Ninox strenua* (Powerful Owl) breeding | Moderate | No | V | - | Figure 30 |
| *Petalura gigantea* (Giant Dragonfly) | High | Yes | E | - | Figure 31 |
| *Petaurus norfolcensis* (Squirrel Glider) | Moderate | No | V | - | Figure 29 |
| *Potorous tridactylus* (Long-nosed Potooroo) | Moderate | No | V | V | Figure 32 |
| *Tyto novaehollandiae* (Masked Owl) breeding | Moderate | No | V | - | Figure 33 |
| *Tyto tenebricosa* (Sooty Owl) breeding | Moderate | No | V | - | Figure 34 |
| *Heleioporus australiacus* (Giant Burrowing Frog) | Moderate | No | V | V | Figure 23 |
| *Pseudophryne australis* (Red-crowned Toadlet) | Moderate | No | V | - | Figure 22 |
| *Phascolarctos cinereus* (Koala) | Moderate | No | V | V | Figure 22 |
| *Isoodon obesulus* (Southern Brown Bandicoot) | High | No | E | E | Figure 27 |
| *Cercartetus nanus* (Eastern Pygmy Possum) | Moderate | No | V | - | Figure 22 |

| Species | Biodiversity risk weighting | SAII candidate | BC Act listing | EPBC Act listing | Potential habitat (Figure #) |
|---|---|---|---|---|---|
| *Myotis macropus* (Southern Myotis) breeding | Moderate | No | V | - | Figure 28 |
| *Lathamus discolor* (Swift Parrot) breeding | Very high | No | E | CE | The Precinct does not contain areas mapped on the "important areas" map |
| *Anthochaera phrygia* (Regent Honeyeater) | Very high | No | CE | CE | The Precinct does not contain areas mapped on the "important areas" map |
| *Varanus rosenbergi* (Rosenberg's Goanna) | Moderate | No | V | - | Figure 26 |

### 4.3.3 Threatened Flora Species Survey Results

No individuals were detected for *Acacia terminalis* subsp. *terminalis*, *Callistemon linearifolius, Darwinia biflora, Epacris purpurascens* var. *purpurascens, Eucalyptus camfieldii, Lasiopetalum joyceae, Leptospermum deanei, Melaleuca deanei, Persoonia hirsuta, Pimelea curviflora* var. *curviflora,* or *Tetratheca glandulosa.*

During the 2014/15 surveys a large number (8,500+) of *Microtis* individuals were detected within the Precinct which at that stage included land north of Mona Vale Rad. Although most individuals detected were suspected to not be *Microtis angusii,* based on published morphological characteristics, a total of 217 samples were genetically tested for species identification. Due to the sensitivity of specific locations for *Microtis angusii*, locations are not provided in this report.

Species identified from the field included *Microtis angusii, Microtis unifolia, Microtis parviflora* and *Microtis rara*. Where individuals could not be reliably assigned to a species in the field, due to lack of diagnostic morphological characteristics (e.g. inflorescent or leaves), they were identified as *Microtis* spp. All *Microtis* individuals were observed at sites associated with disturbance, with the vast majority recorded on road verges, particularly at the interface of slashed and non-slashed vegetation. Other sites' *Microtis* were recorded at included small drainage channels next to roads, mown lawns, amongst exotic grasses, recently burnt vegetation, mulch, and a single individual was recorded in a pot plant.

A total of approximately 8,500 *Microtis* individuals were counted and classified into species based on morphological characteristics (across the former Ingleside Precinct, including land north of Mona Vale Road). Leaf samples from individuals at each population were sent for genetic analysis. The samples sent for genetic analysis were used as the basis for determining population numbers, as *Microtis* species are found in clusters or colonies. Thus, all individuals from the population were assigned to the species confirmed through the genetic analysis sample. Four distinguishable species were confirmed from the genetic analysis. However, these differed from the field surveys. The notable difference being that no *Microtis unifolia* individuals were identified from the genetic testing (**Table 8**).

Individuals typically identified from the field surveys as *Microtis unifolia* were confirmed as *Microtis angusii* from the genetic analysis.

**Table 8: *Microtis* field survey and genetic analysis results**

| Species | *Microtis* populations estimated from field survey* | Samples confirmed from genetic analysis | Population count based on genetic results |
|---|---|---|---|
| *Microtis angusii* | 139 | 101 | 4276 |
| *Microtis unifolia* | 4107 | 0 | 0 |
| *Microtis parviflora* | 1976[1] | 113 | 3659 |
| *Microtis rara* | 52 | 2 | 573 |
| *Microtis spp.* | 2240 | N/A | N/A |
| *Microtis affiliate angusii* | 0 | 1 | 6 |
| **Total** | **8514** | **217** | **8514** |

* Caution is required when interpreting population numbers identified from the field, as morphological characteristics required for identification between species may have been absent or required high powered microscopes. The intention of the field survey was to collect samples for genetic identification. Thus, population numbers from the field survey is an estimate only.

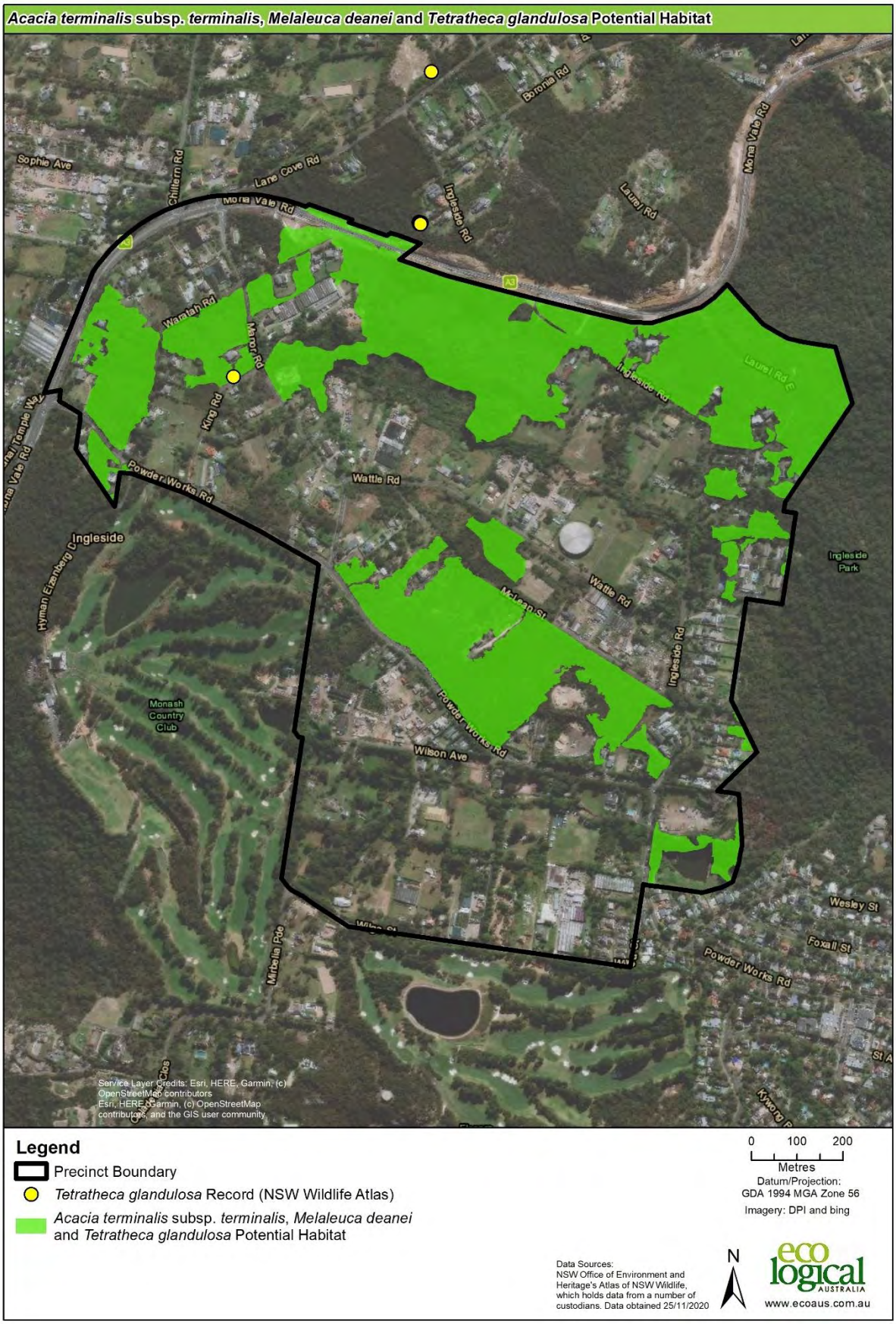


**Figure 12: Potential habitat for *Acacia terminalis* subsp. *terminalis, Melaleuca deanei* and *Tetratheca glandulosa* in the precinct**

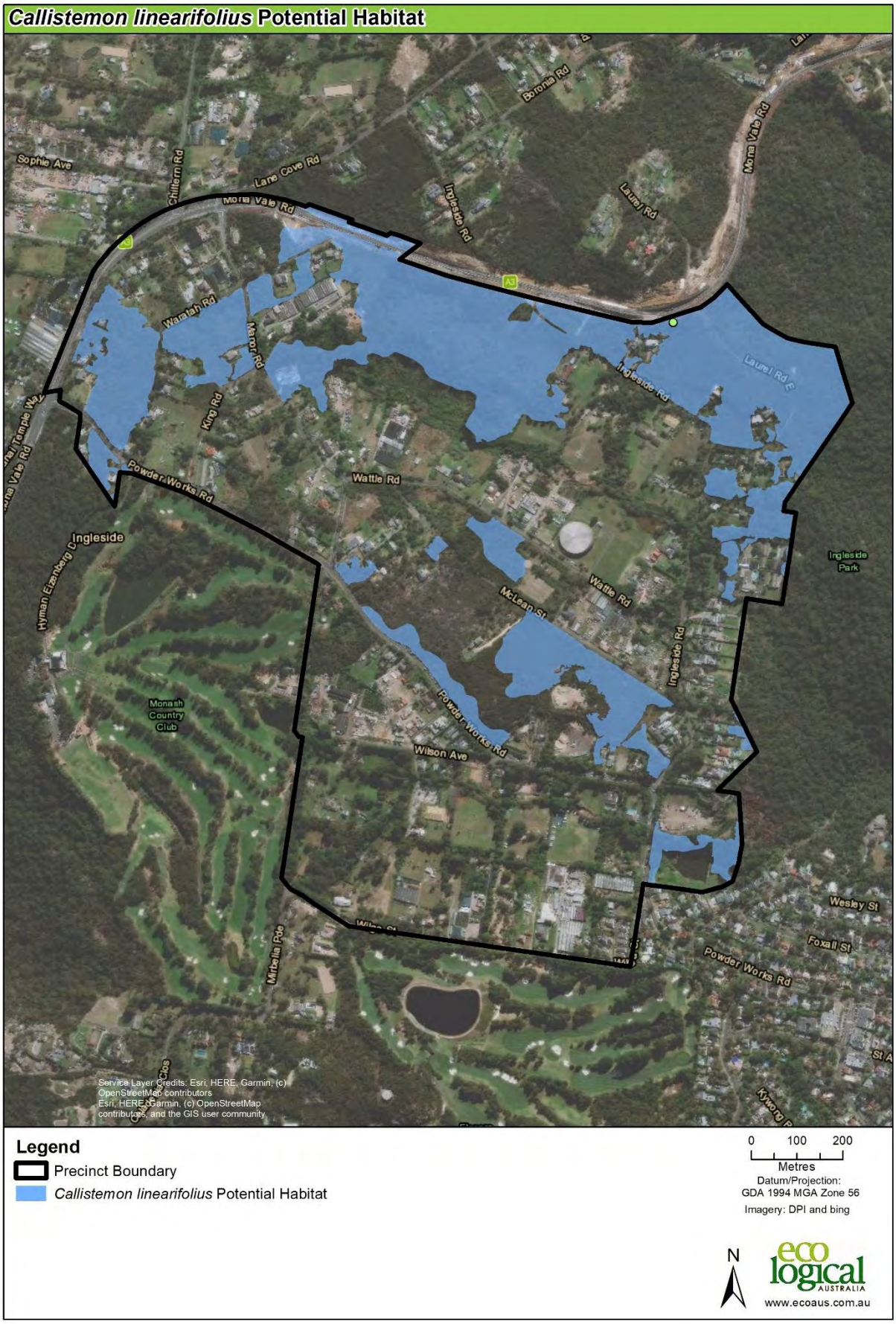


**Figure 13: Potential habitat for *Callistemon linearifolius* in the precinct**

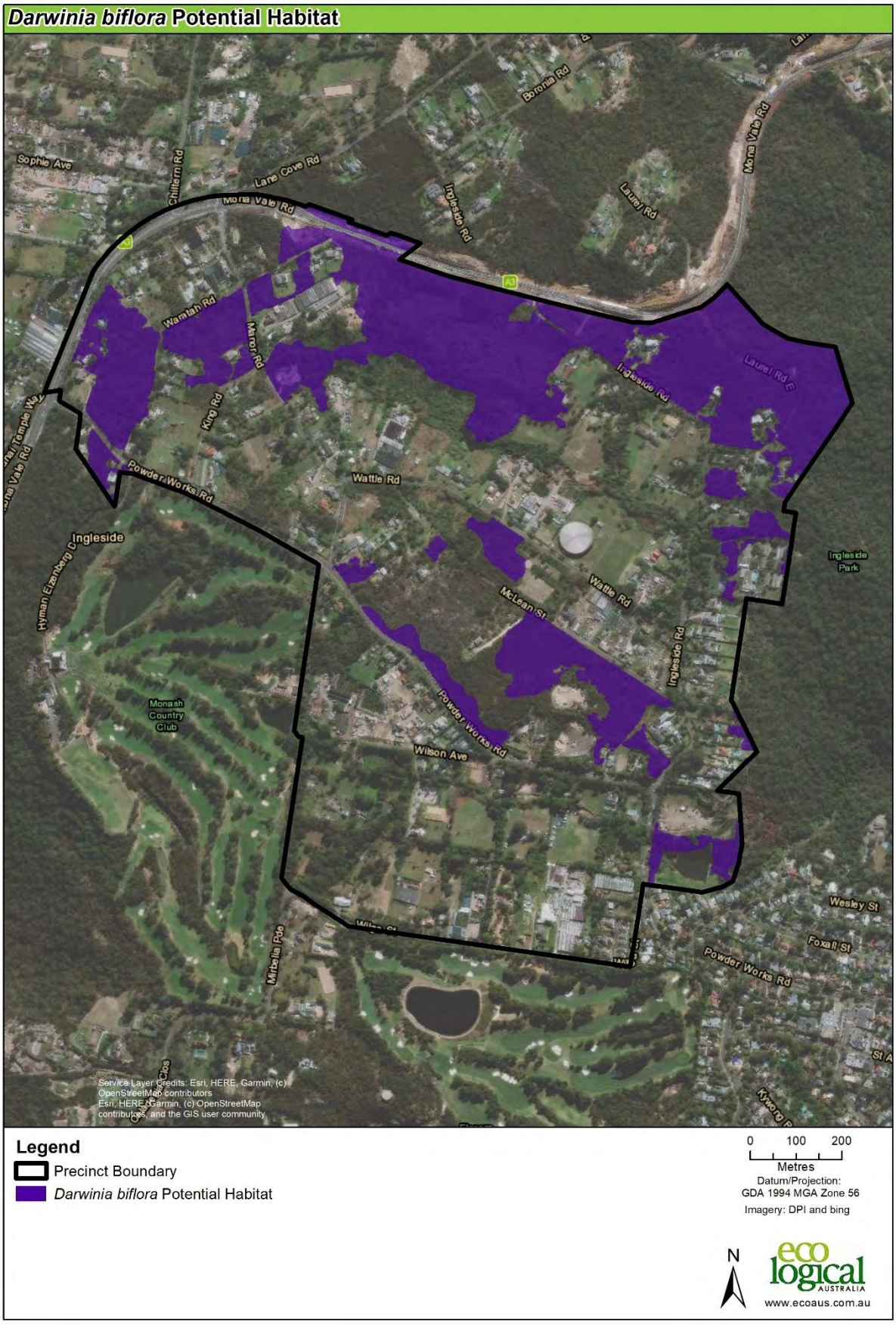


**Figure 14: Potential habitat for *Darwinia biflora* in the precinct**

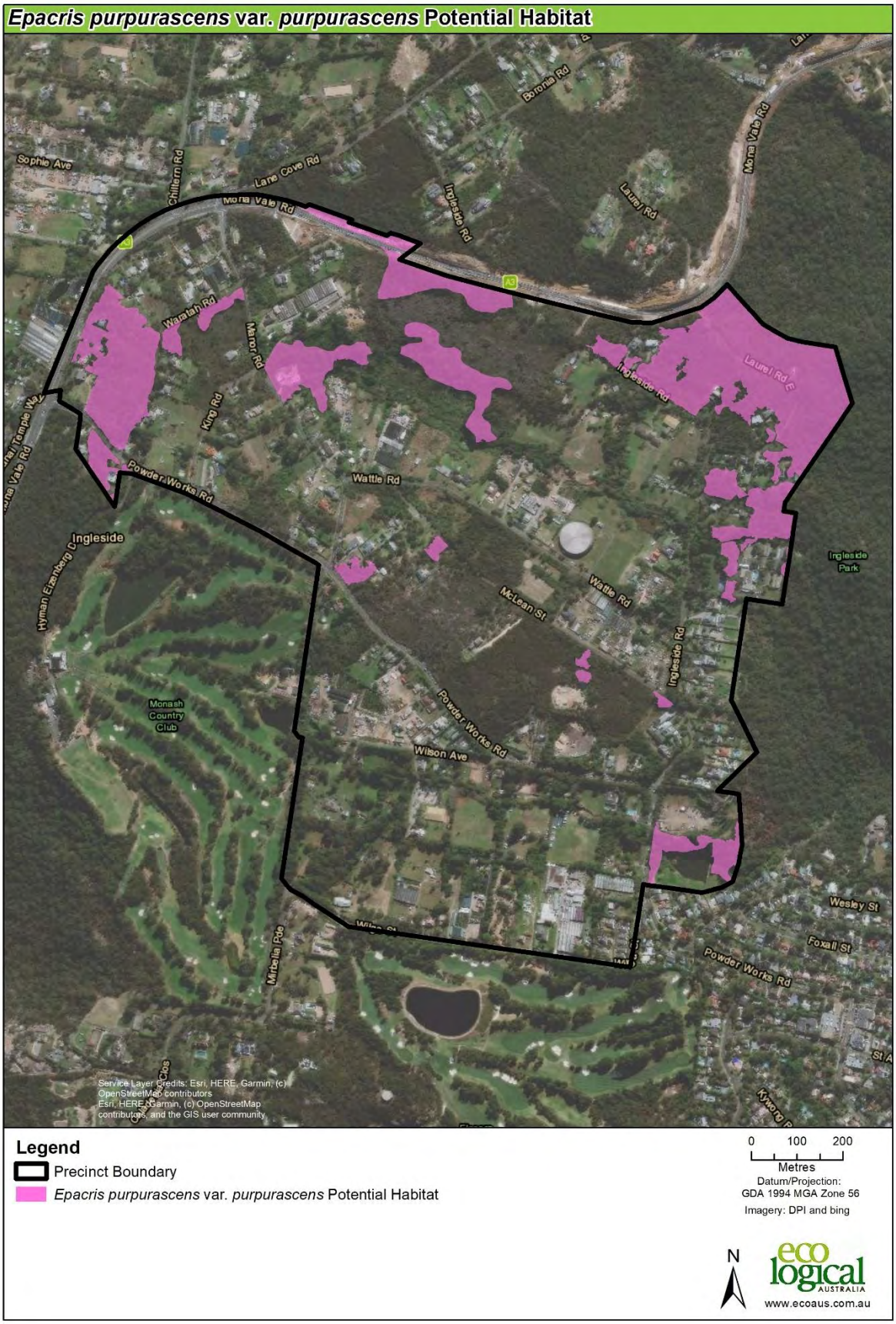


**Figure 15: Potential habitat for *Epacris purpurascens* var. *purpurascens* in the precinct**

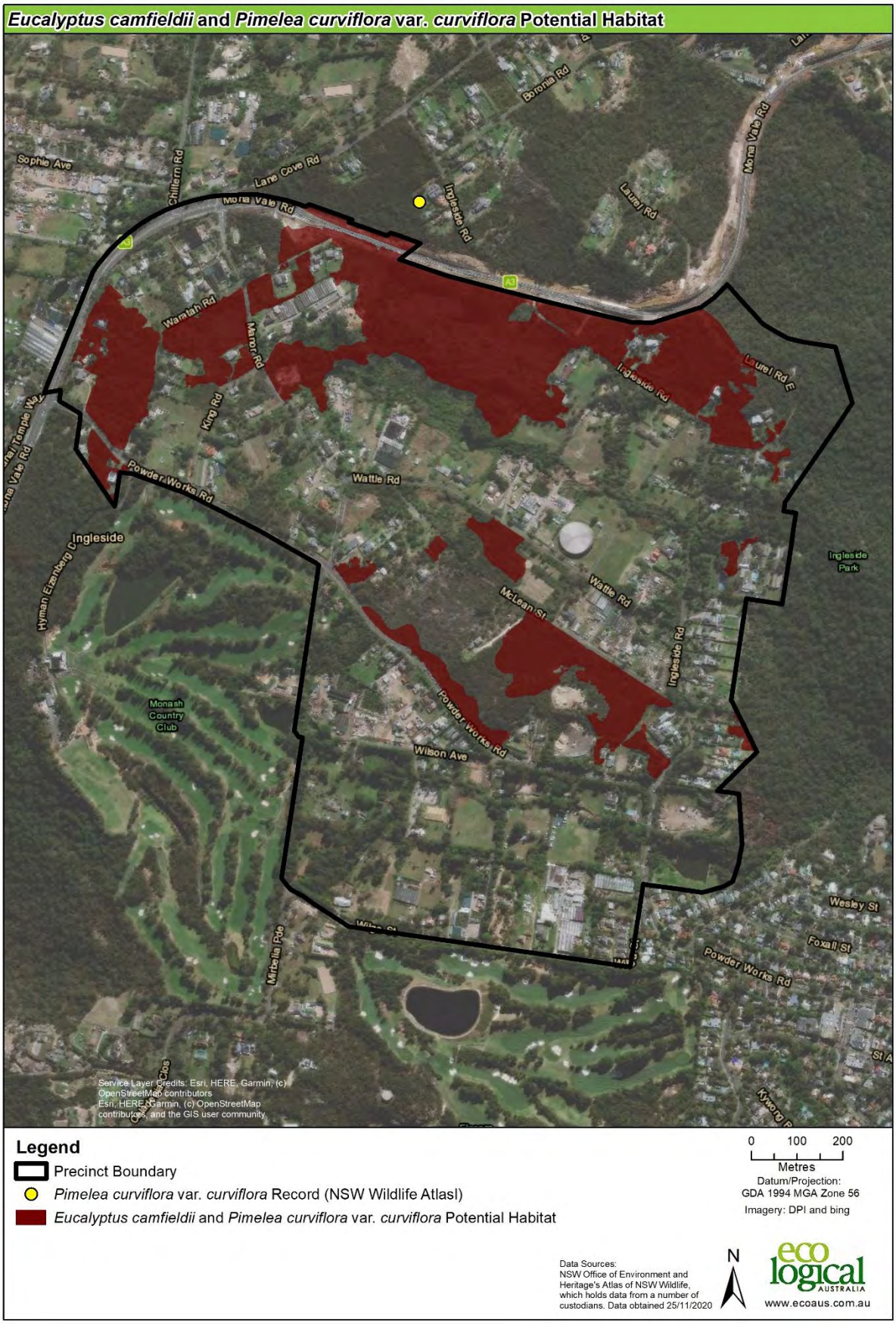


**Figure 16: Potential habitat for *Eucalyptus camfieldii* and *Pimelea curviflora* var. *curviflora* in the precinct**

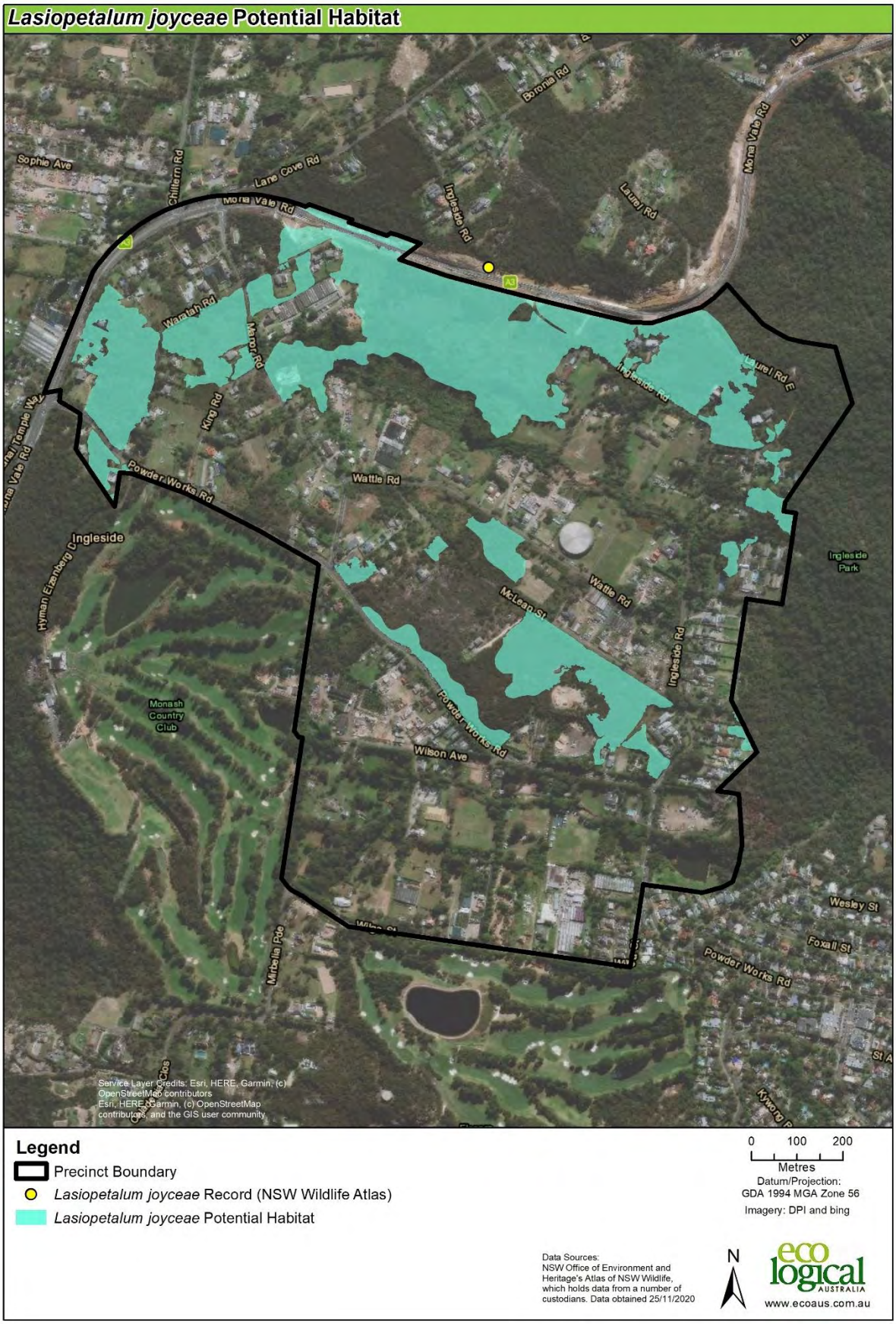


**Figure 17: Potential habitat for *Lasiopetalum joyceae* in the precinct**

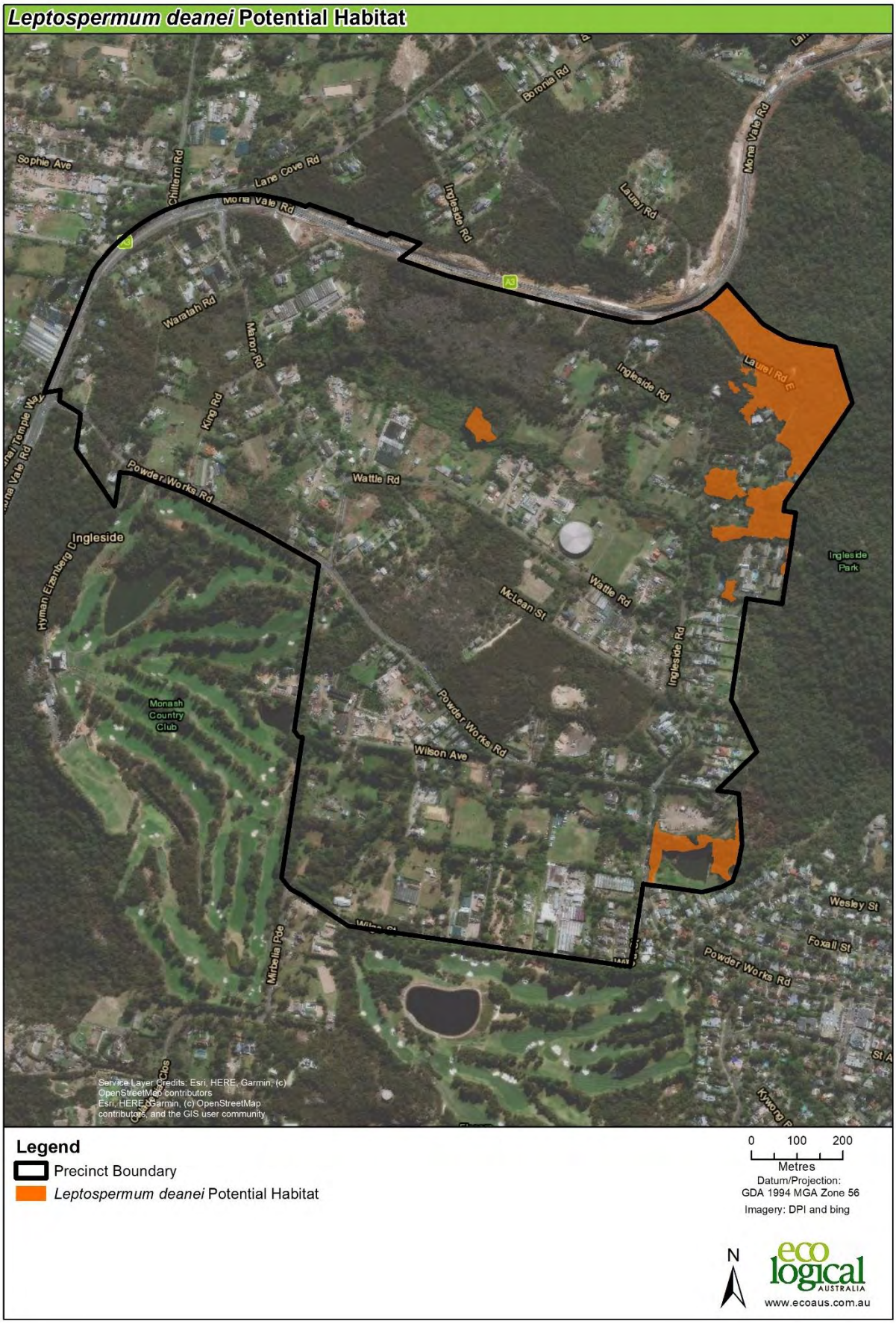


**Figure 18: Potential habitat for *Leptospermum deanei* in the precinct**

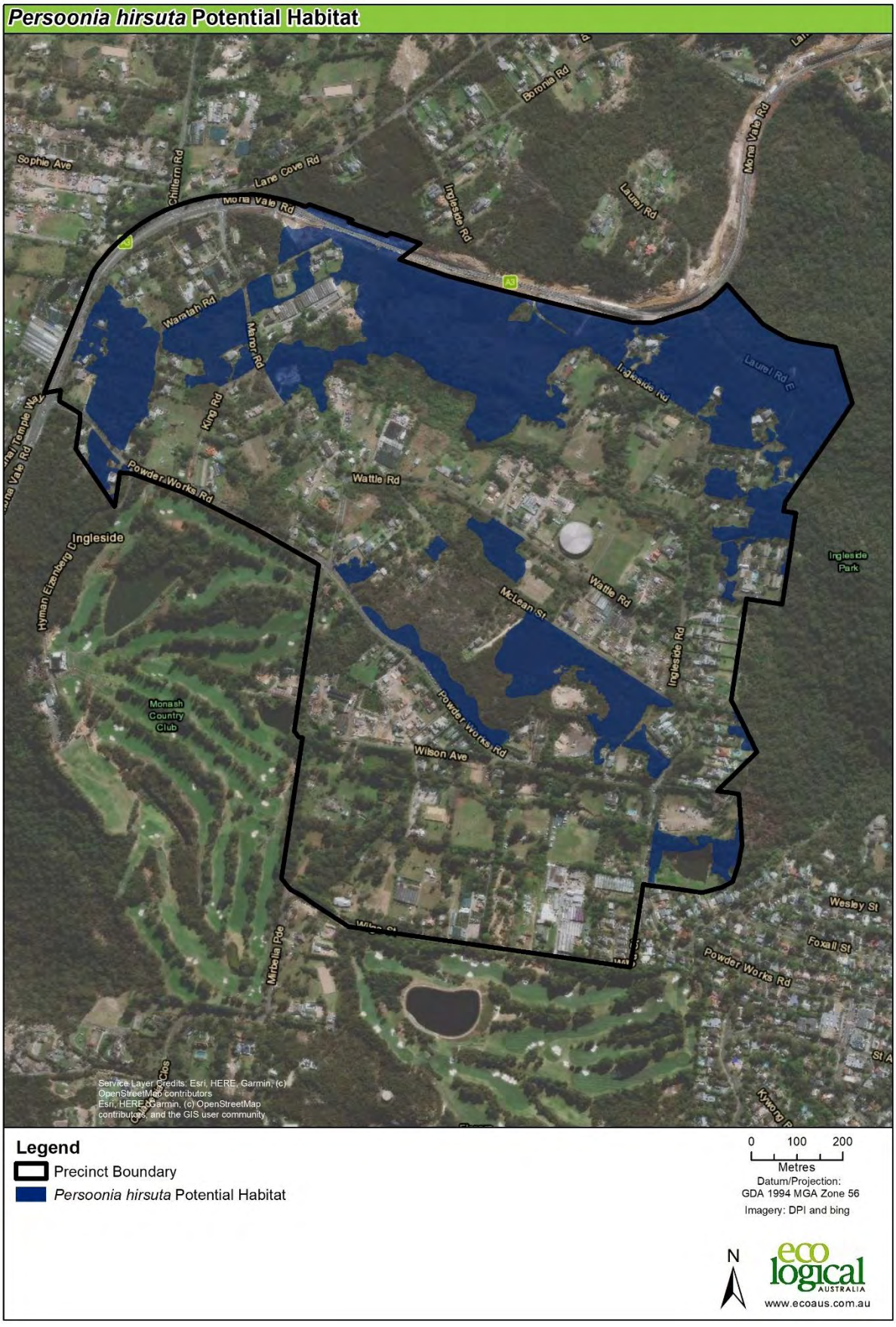


**Figure 19: Potential habitat for *Persoonia hirsuta* in the precinct**

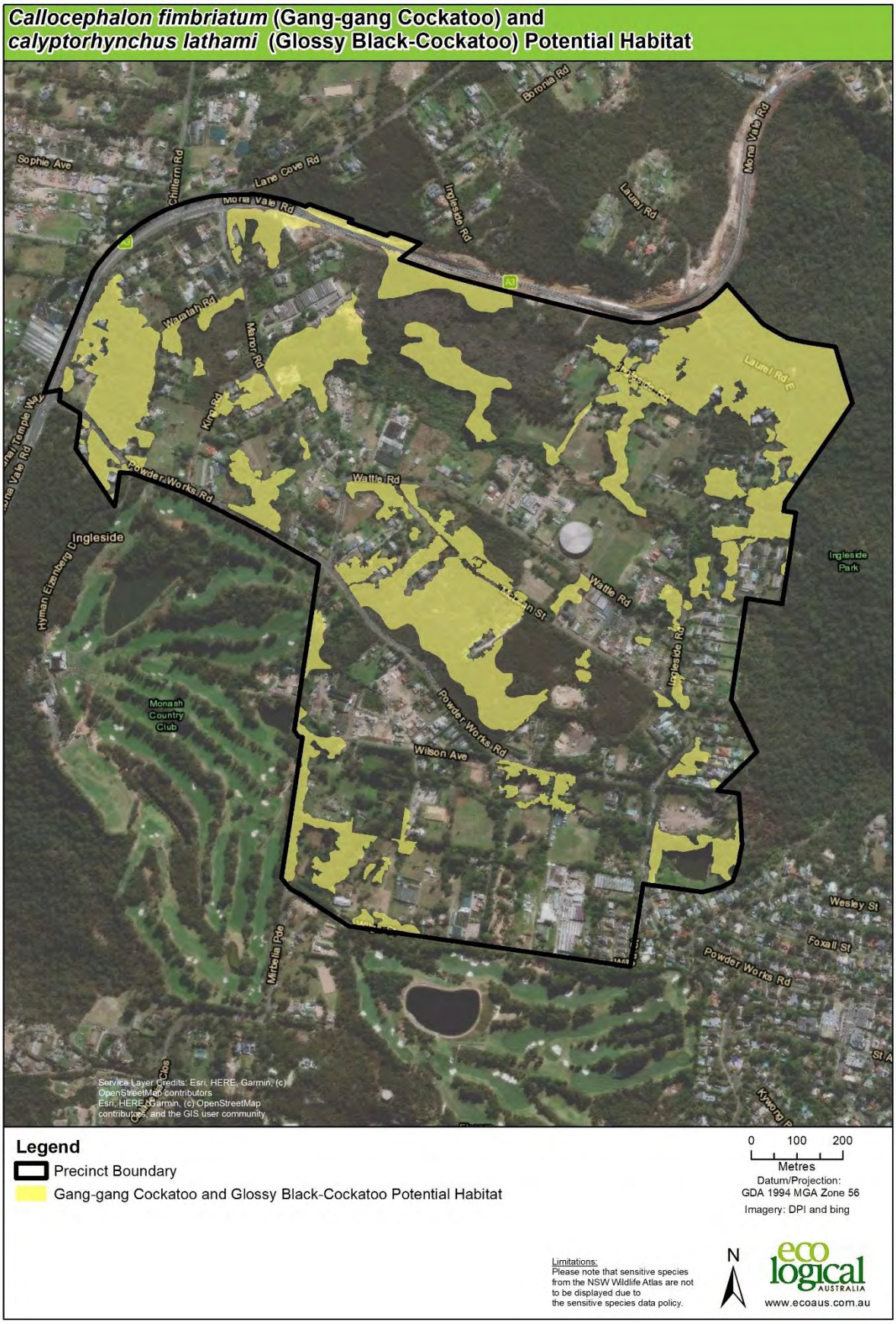


**Figure 20: Potential habitat for Gang-gang Cockatoo and Glossy Black-cockatoo in the precinct**

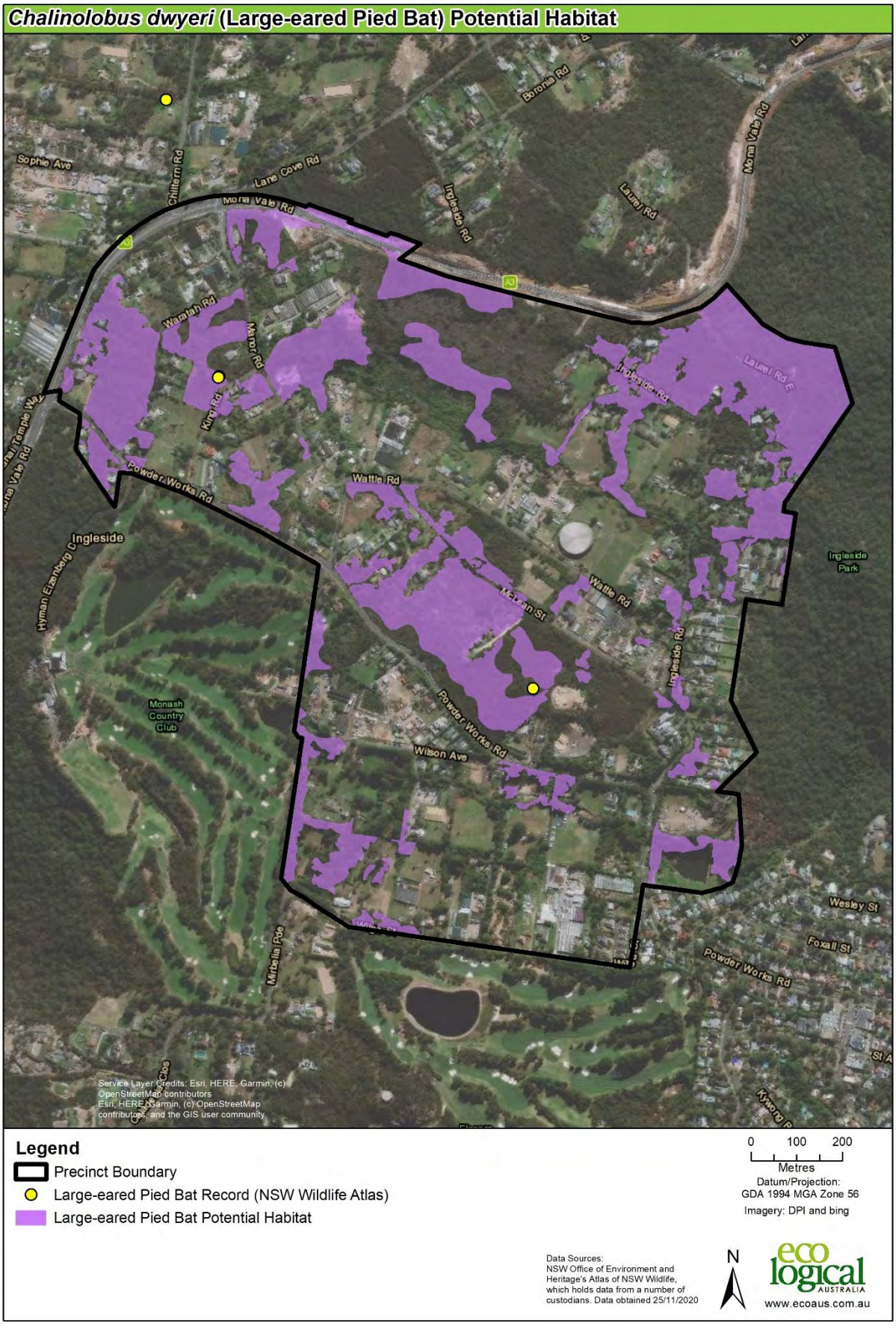


**Figure 21: Potential habitat for the Large-eared Pied bat in the precinct**

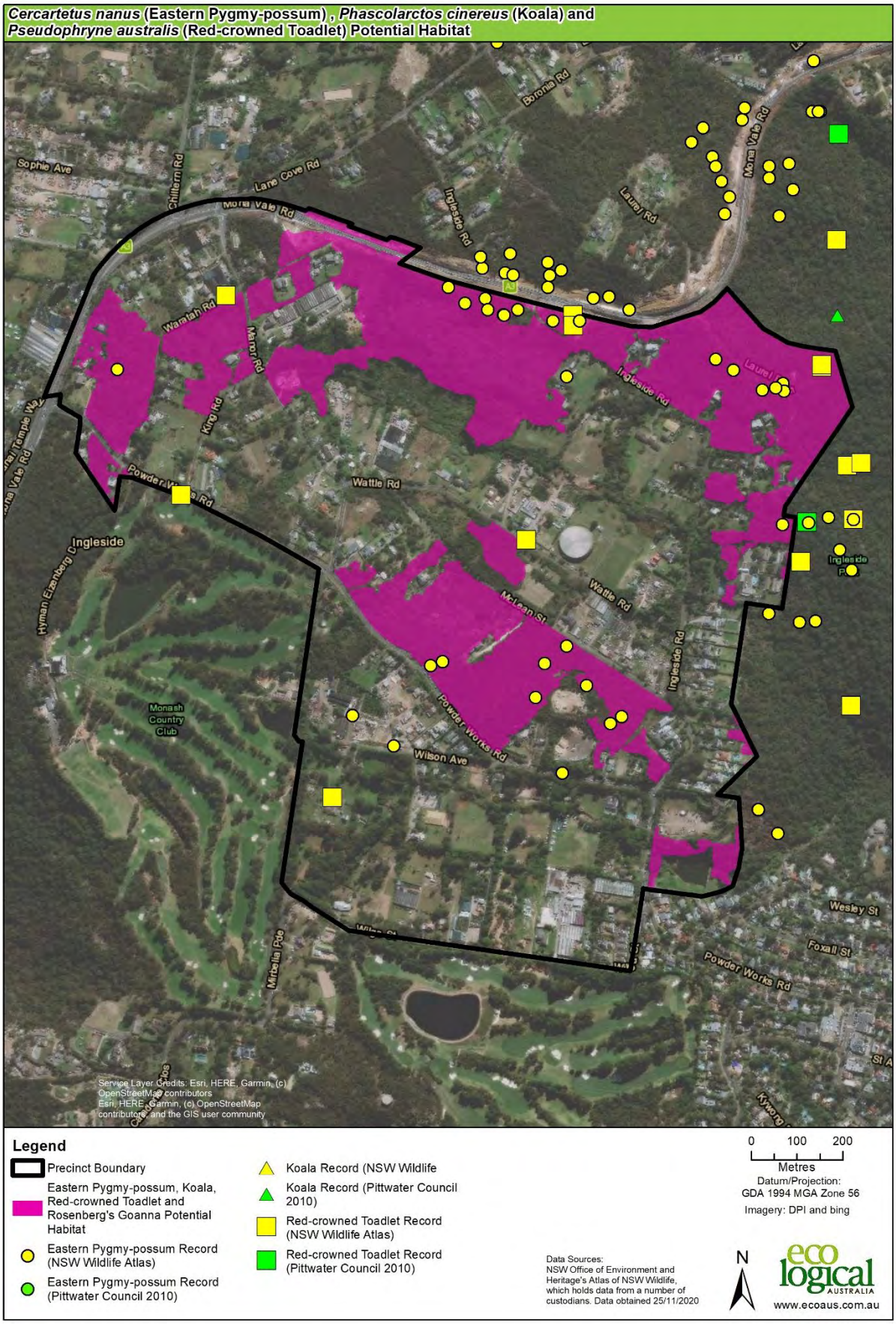


**Figure 22: Potential habitat for Eastern Pygmy Possum, Koala and Red-crowned Toadlet**

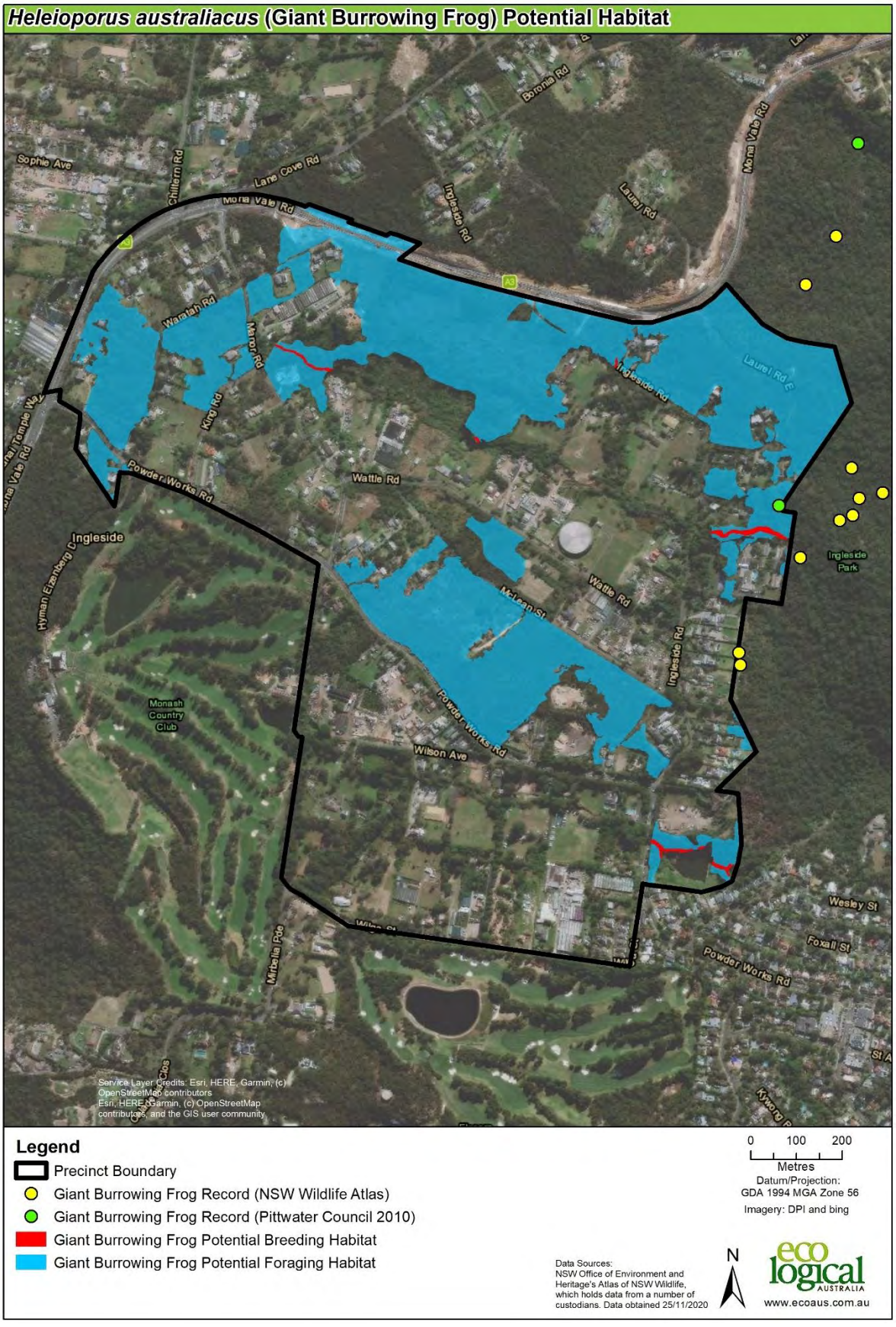


**Figure 23: Potential habitat for Giant Burrowing Frog**

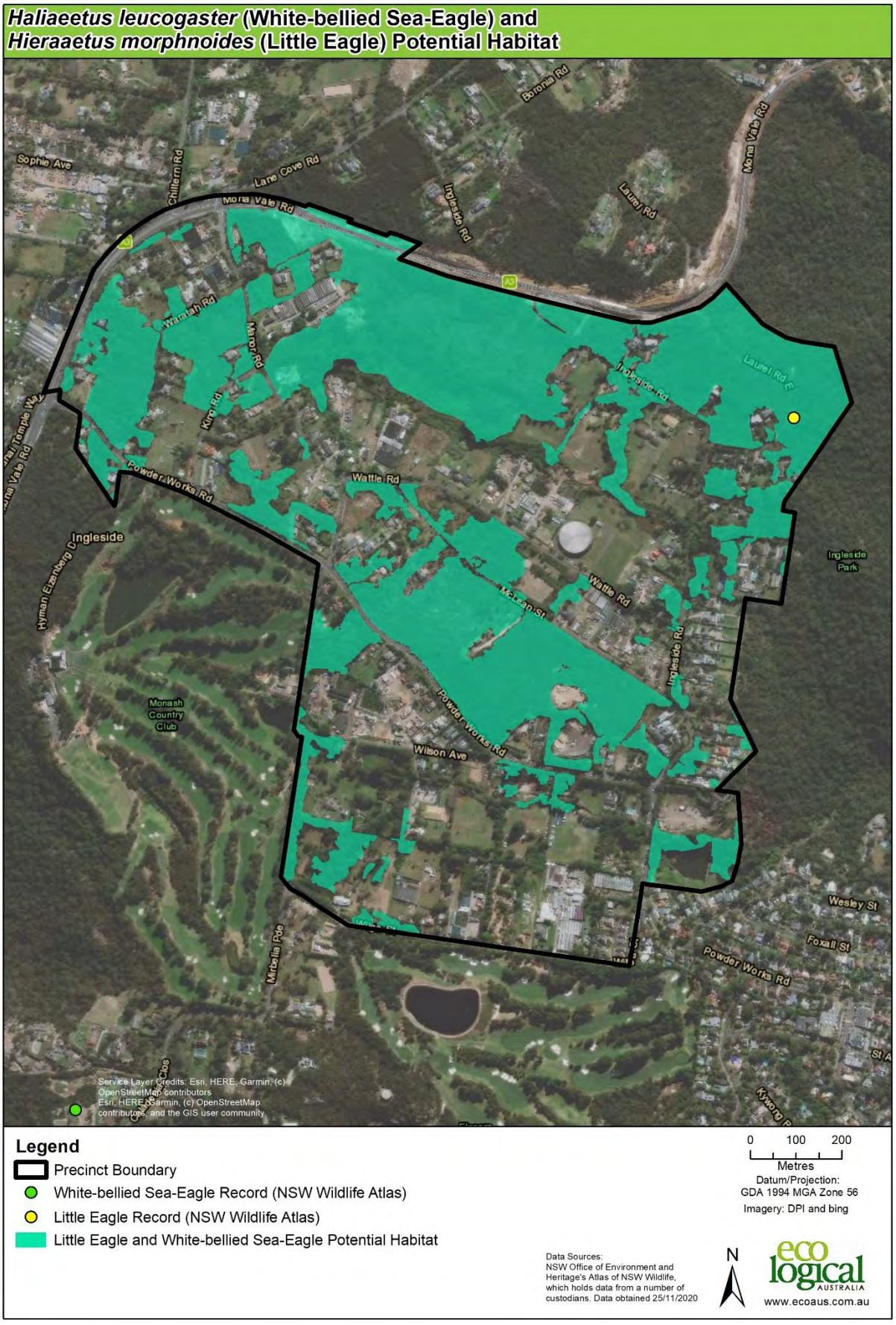


**Figure 24: Potential habitat for White-bellied Sea Eagle and Little Eagle in the precinct**

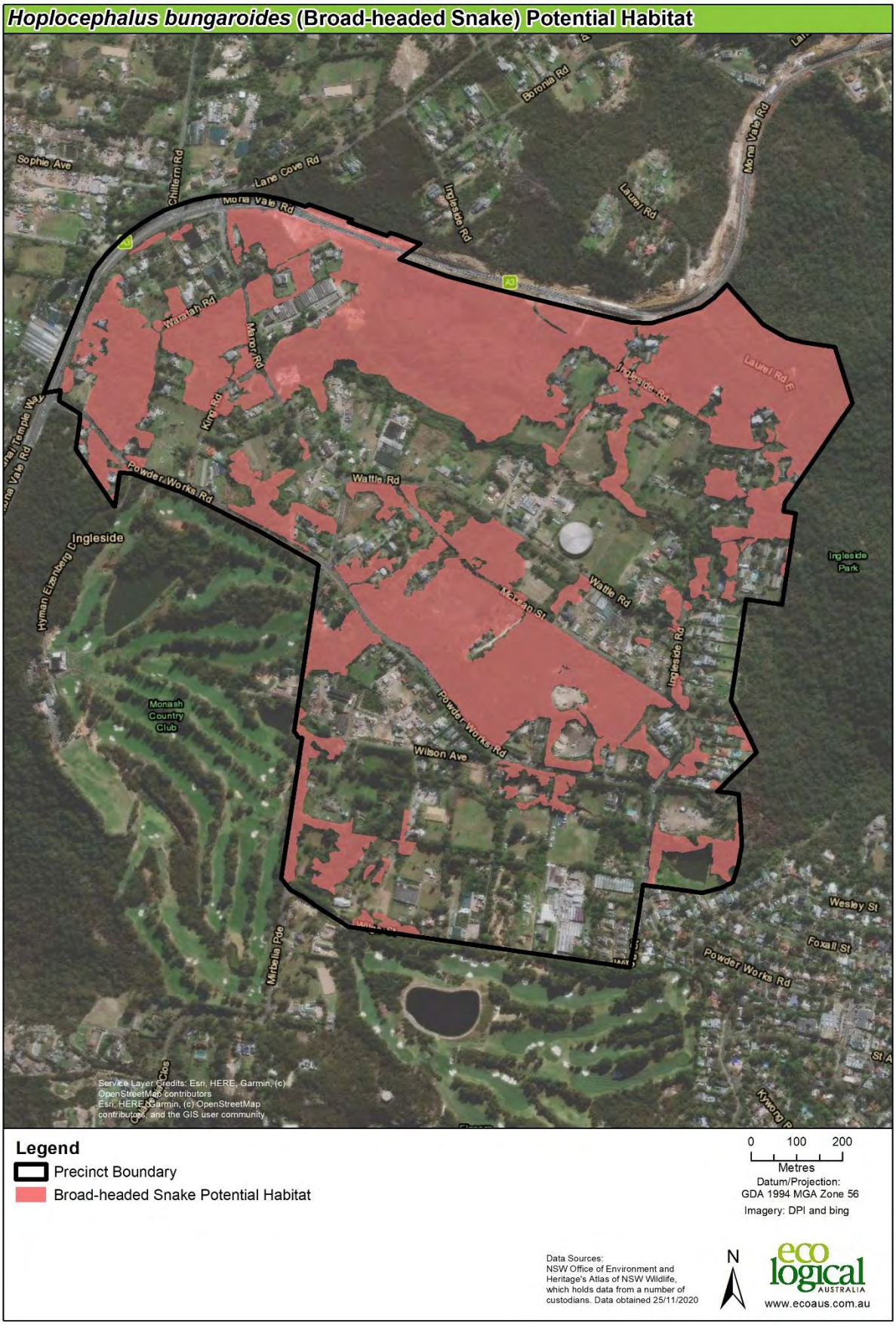


**Figure 25: Potential habitat for Broad-headed Snake in the precinct**

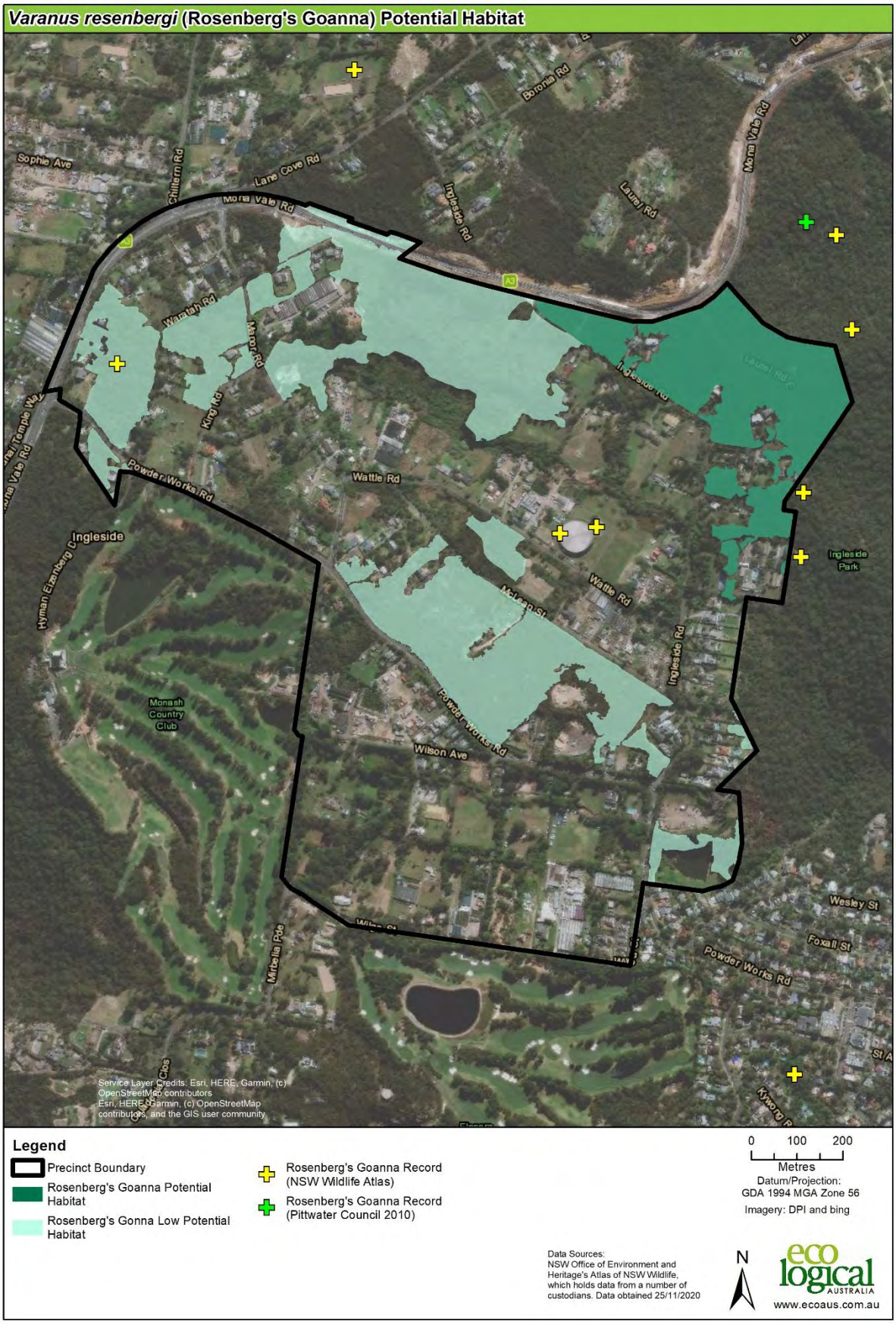


**Figure 26: Potential habitat Rosenberg's Goanna in the precinct**

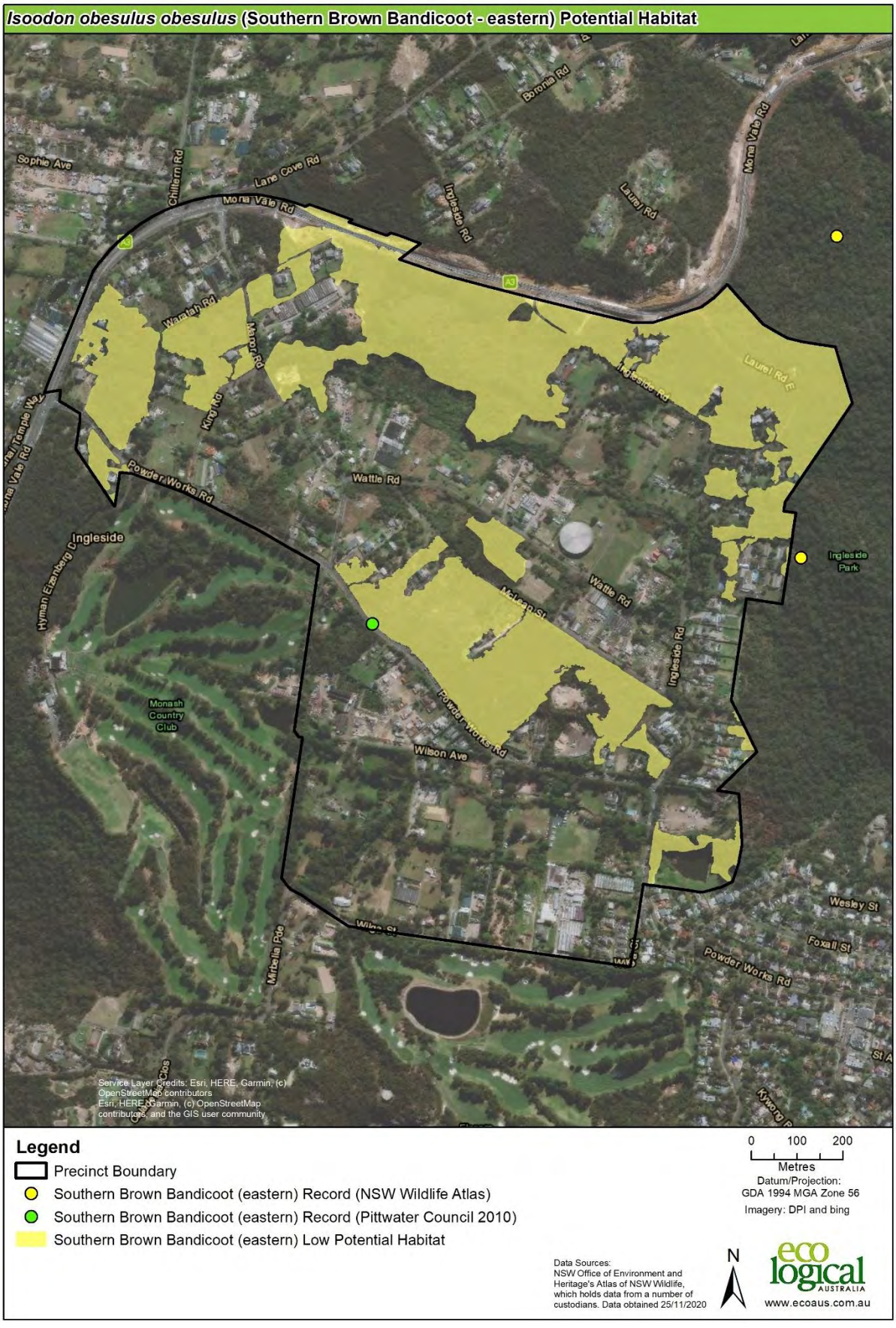


**Figure 27: Potential habitat for Southern Brown Bandicoot in the precinct**

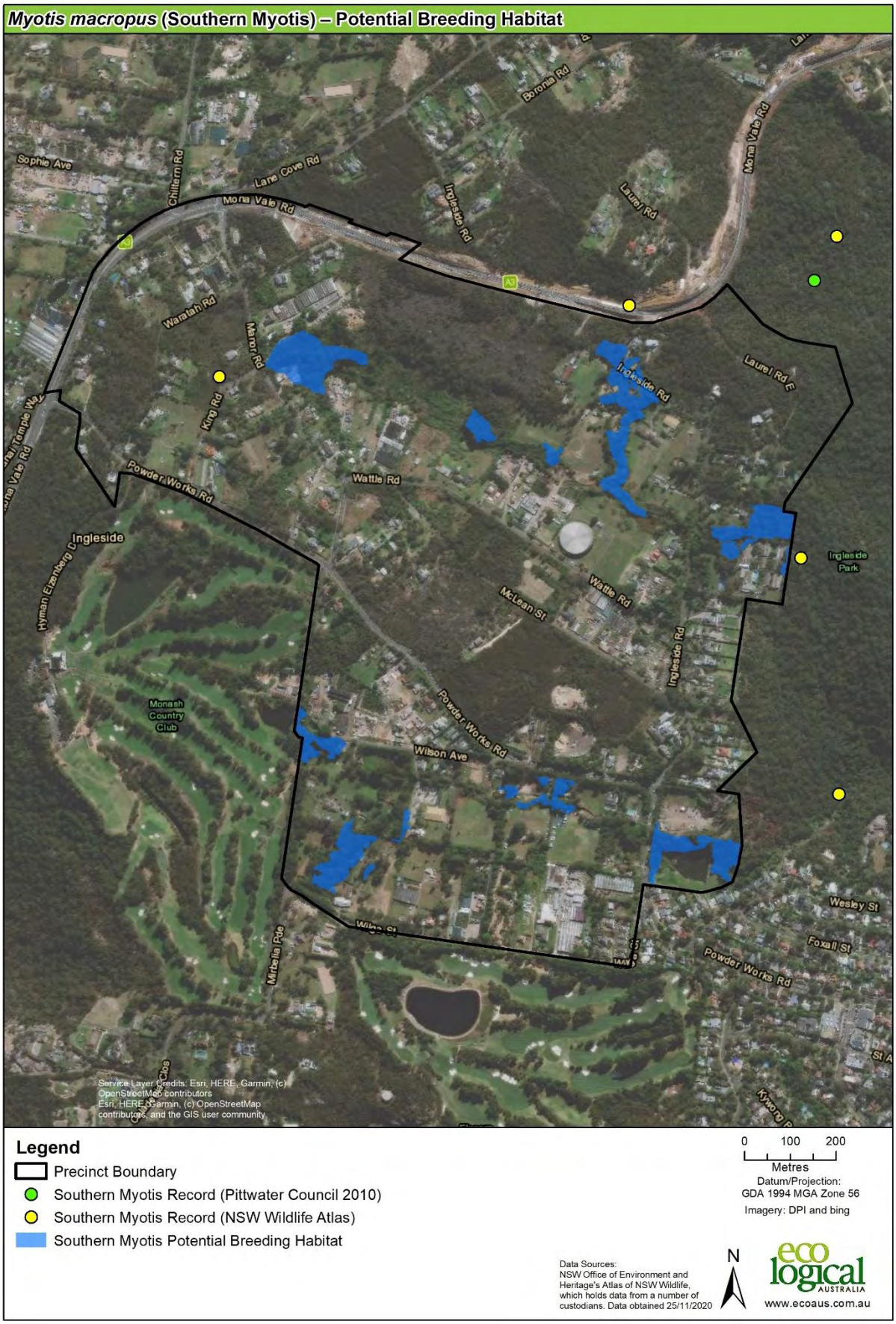


**Figure 28: Potential habitat for Southern Myotis**

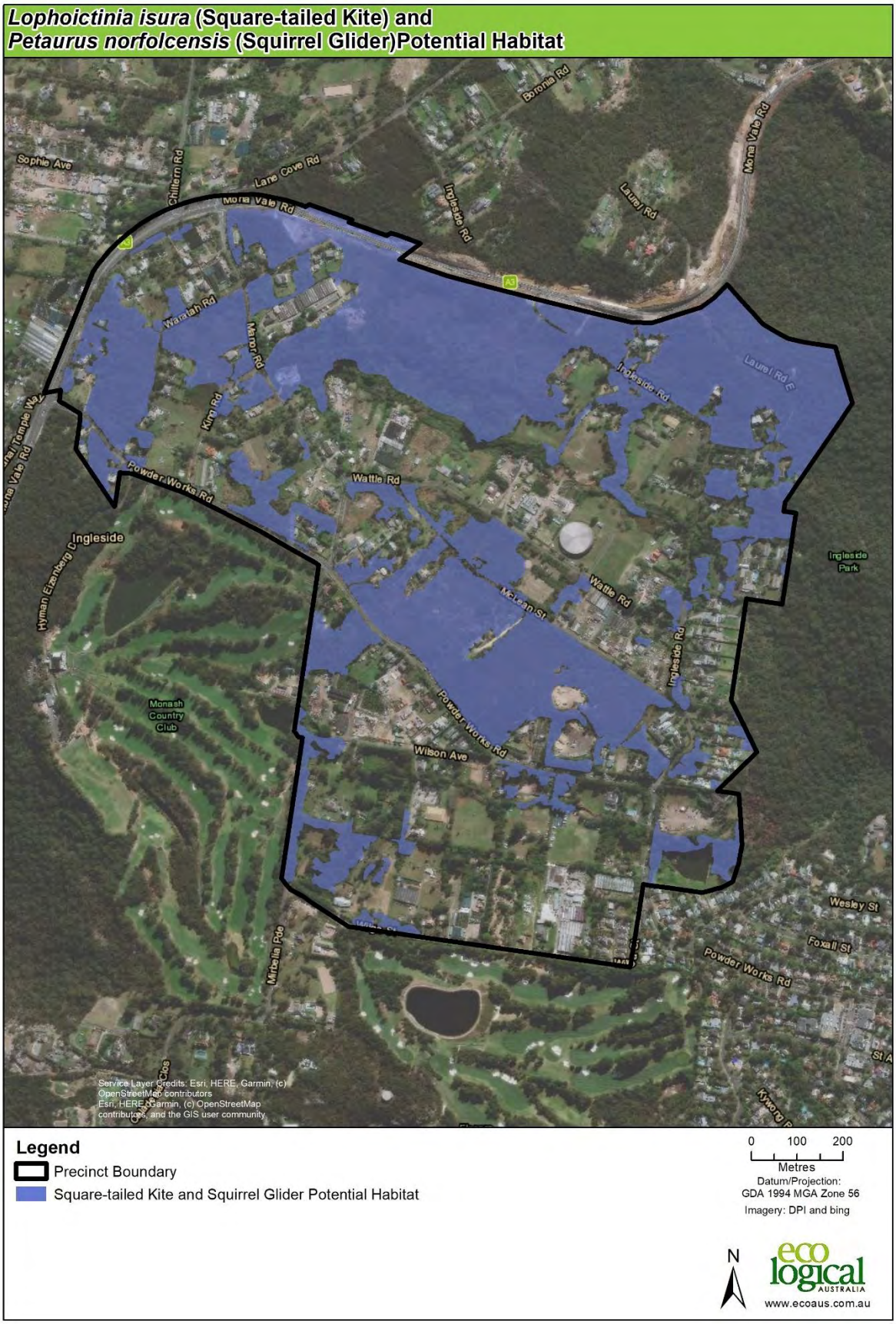


**Figure 29: Potential habitat for Square-tailed Kite and Squirrel Glider in the precinct**

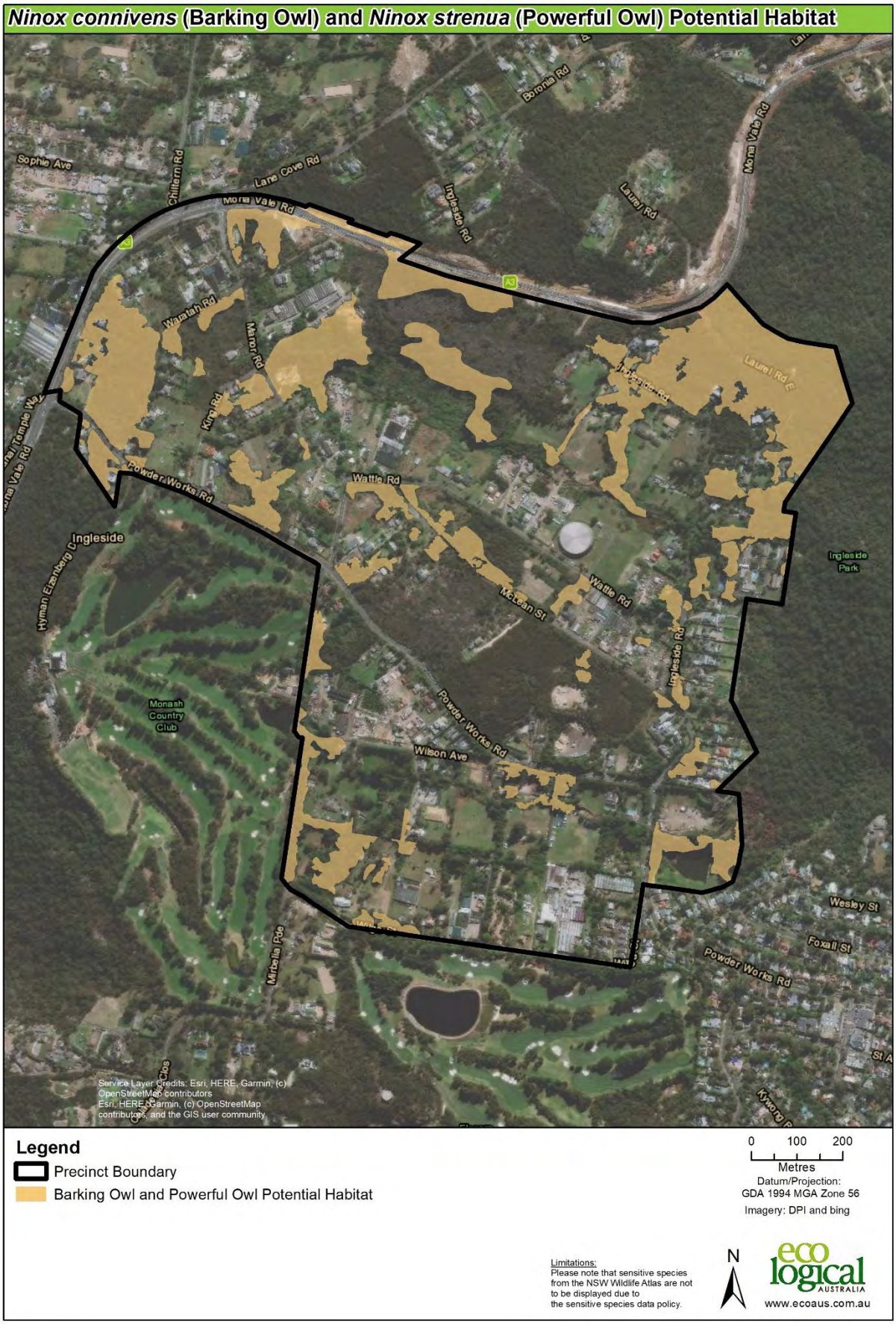


**Figure 30: Potential habitat for Barking Owl and Powerful Owl**

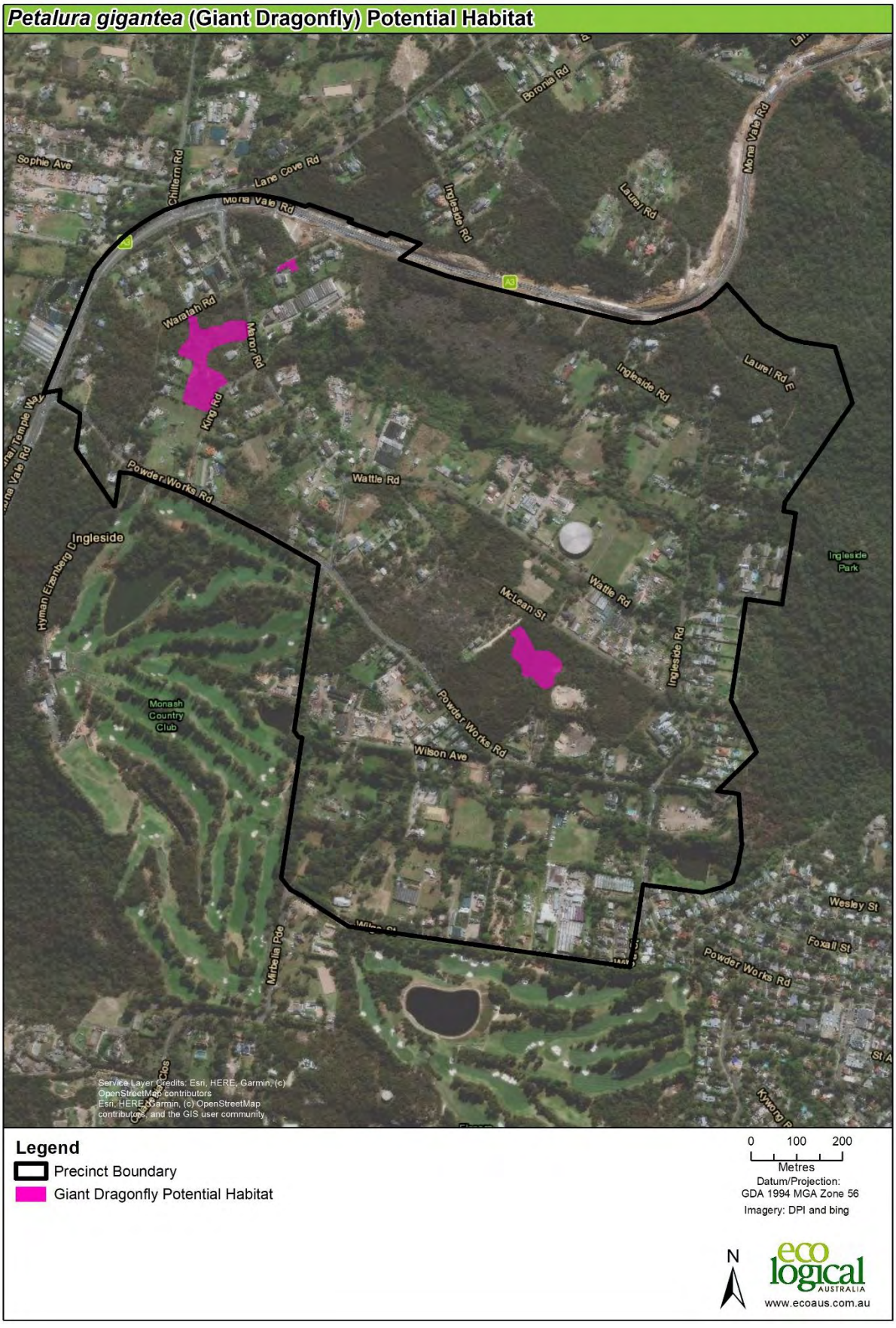


**Figure 31: Potential habitat for Giant Dragonfly in the Precinct**

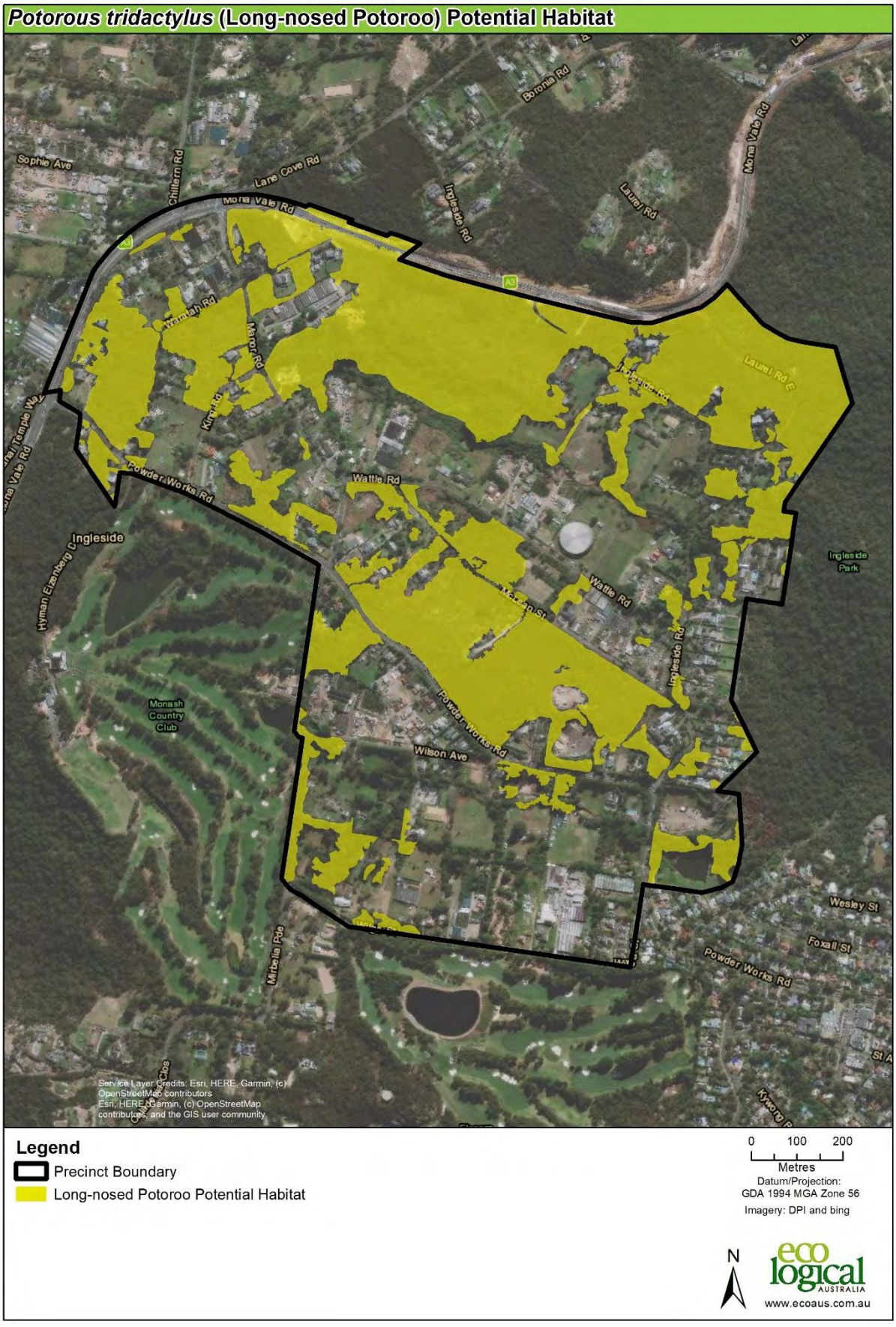


**Figure 32: Potential habitat for Long-nosed Potoroo in the precinct**

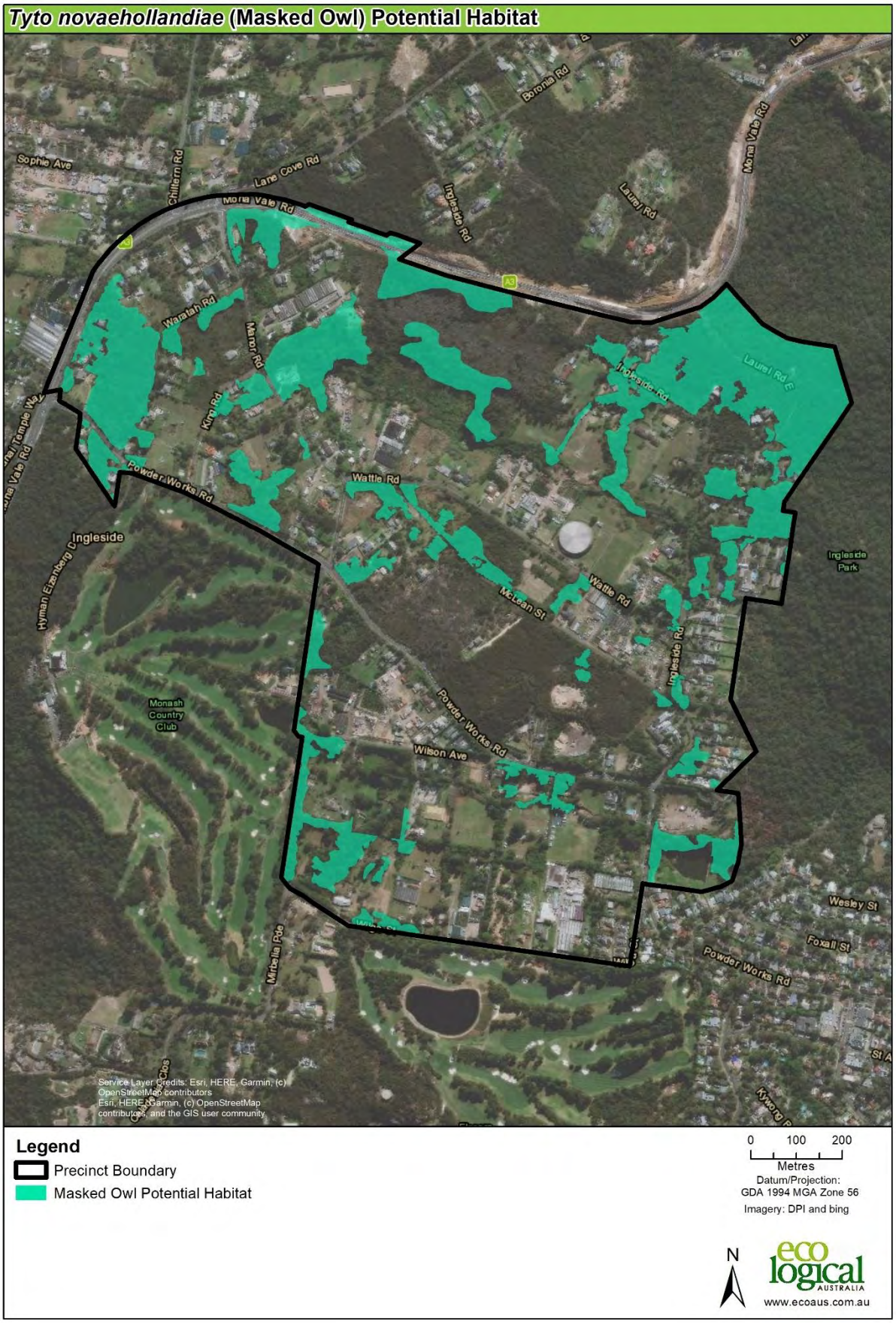


**Figure 33: Potential habitat for Masked Owl in the precinct**

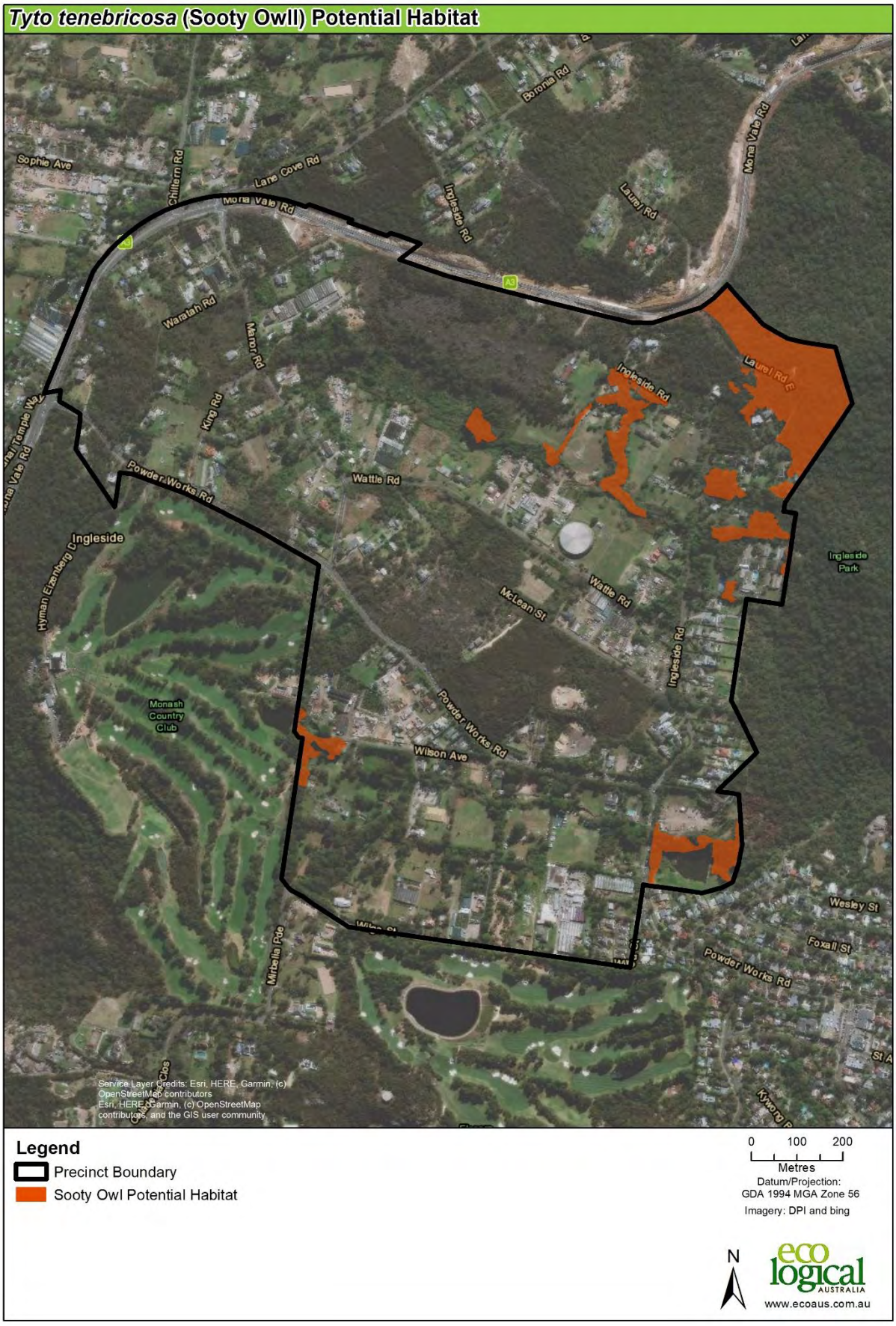


**Figure 34: Potential habitat for Sooty Owl in the precinct**

## 4.4 Ecological connectivity and wildlife

Ingleside Precinct is surrounded by large tracts of continuous vegetation. The most significant are conservation areas located along the western perimeter of the Precinct. Garigal National Park on the southern side of Mona Vale Road is 22 $km^2$ in area (**Figure 1**). Significant habitat for threatened flora and fauna species is represented within this National Park. Connectivity to other large areas of native vegetation within the broader landscape (Ku-ring-gai National Park) is fragmented by Mona Vale Road.

The Precinct incorporates a small portion of the adjoining National Park within the precinct boundary. The south-western corner is located on National Park tenure. It forms an important link with Garigal National Park. The eastern boundary adjoins Ingleside Chase Reserve.

Due to the current low-density development within the Ingleside Precinct, connectivity within the landscape consists of intact patches of vegetation interspersed with cleared and scattered vegetation. Connectivity between the east and north, and east and west areas, are currently present in a fragmented form. Clearing, fragmented vegetation, and roads have reduced the extent of vegetation connections in the Precinct.

The most significant link exists between Garigal National Park in the south west and Ingleside Chase Reserve on the east (Figure **36**). Minor links exist between the east and west extending into the locality to Ku-ring-gai Chase National Park and Katandra Bushland Reserve.

The rezoning should aim to maintain these areas of connectivity throughout the precinct. Due to the access limitations and changes in listings, not all EECs were known within the precinct and therefore some areas were not included within the wildlife corridors.

## 4.5 Potential SAII

Serious and Irreversible Impacts (SAII) are entities (threatened ecological communities, flora or fauna species) are considered entities that are at the most risk of extinction from developments or activities. When submitting an impact assessment to a consent authority under the BC Act, the consent authority is required to determine whether any of the residual impacts of a proposed development or activity or vegetation clearing on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been taken) are serious and irreversible. If the consent authority determines that the residual impact is serious and irreversible, the proposed development, action or vegetation clearing must be refused.

The following entities are listed as SAII candidates and were identified in the Precinct:

- *Grevillea caleyi* (Caley's Grevillea)
- *Microtis angusii* (Angus's Onion Orchid).

The following SAII entities, although not identified as present are considered likely to occur:

- *Persoonia hirsuta* (Hairy Geebung)
- *Petalura gigantea* (Giant Dragonfly).

## 4.6 Pittwater LEP biodiversity overlay

A majority of the native vegetation in the Precinct is mapped on the Pittwater LEP Biodiversity Overlay map. Any future development on lands mapped on the overlay would be required to address Section 7.6 of the LEP. This layer provides additional protection to the vegetation which it covers (Figure 35).


**Figure 35: Pittwater LEP terrestrial biodiversity overlay**

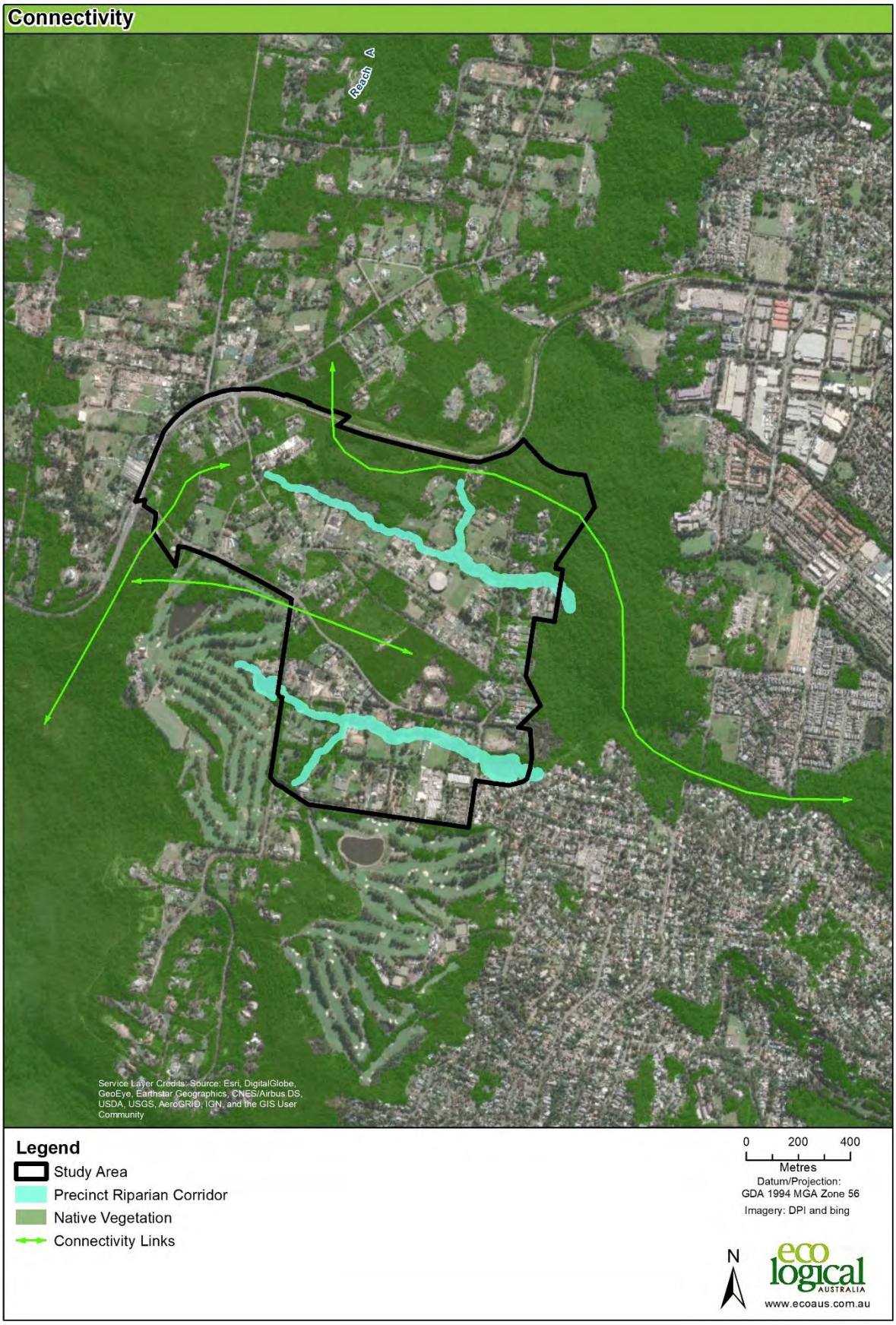


**Figure** 36**: Connectivity throughout the landscape**

# 5. Draft structure plan outcomes

## 5.1 Vegetation

The Draft Structure Plan has been assessed for its ecological impacts and the broad outcomes are described in Table 9 and summarised below:

- 19.26 ha of native vegetation would be zoned E2 Environmental Conservation. These areas are largely connected to areas of native vegetation that extends beyond the precinct. This native vegetation provides habitat for some of the threatened flora and fauna species predicted as either known, likely or having potential to occur in the precinct.
- 44.85 ha of native vegetation would remain in open space and rural zones including RE1, RE2, RU2 and R2.
- 3.93 ha of vegetation falls within the zones for development (B1, R3, SP2). Whilst some vegetation may be retained through careful design, the retention of the majority of this vegetation is unlikely.

One endangered ecological community is located within the Ingleside Precinct. According to the current vegetation mapping, a small area of 0.11 ha of Coastal Upland Swamp (PCT 978) would be affected by the rezoning, but the remainder (0.29ha) would be located on Environmental Conservation land (Figure 2).

**Table 9: Summary of plant community types and rezoning categories**

| PCT | Zoning (hectares) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | B1 | R3 | SP2 | E2 | RE1 | RE2 | RU2 | R2 | Grand Total |
| Coastal Enriched Sandstone Dry Forest | | | | 0.37 | | | 0.14 | | **0.52** |
| Coastal Sandstone Gully Forest | | | 0.42 | 1.72 | | 0.84 | 7.11 | 0.1 | **10.19** |
| Coastal Sandstone Heath-Mallee | | | 1.1 | 7.95 | 1.1 | | 9.87 | 5.12 | **25.13** |
| Coastal Sandstone Rock Plate Heath | 0.16 | | | 4.62 | | | | 1.64 | **6.42** |
| Coastal Upland Damp Heath Swamp | | | | 0.29 | | | | 0.11 | **0.4** |
| Hornsby Enriched Sandstone Exposed Woodland | 0.41 | 0.61 | 1.23 | 4.31 | 1.08 | | 7.84 | 9.9 | **25.38** |
| **Subtotal** | 0.57 | 0.61 | 2.75 | 19.26 | 2.18 | 0.84 | 24.96 | 16.87 | **68.04** |
| **Total** | | **3.93** | | **19.26** | | | **44.85** | | **68.04** |

## 5.2 Threatened species

Due to the uncertainty regarding the current classification of *Microtis angusii*, a precautionary approach has been taken. Based on this approach, approximately 69% of *Microtis angusii* recorded across the precinct are proposed to be conserved in an environmental conservation land use (Figure 2).

**Table 10: *Microtis angusii* individuals on Environmental Conservation zoned land and development land in the precinct**

| Precinct land use | No. of *Microtis angusii* | Percentage |
|---|---|---|
| Conservation | 2,966 | ~ 69% |
| Retained | 937 | ~ 22% |
| Development | 373 | ~ 9% |
| **Total** | **4,276** | |

## 5.3 Future development

This assessment provides a strategic overview of the precinct and the planning proposal. If the precinct plan proceeds, detailed biodiversity assessment of Development Applications in accordance with the Biodiversity Conservation Act will be required. This is likely to require additional survey for some species credit species and may require preparation of a Biodiversity Development Assessment Report (BDAR) with a development application (DA). As part of the BDAR, consideration must be given to candidate SAII entities as described in Section 4.5 and any other candidate SAII entities that may be listed.

ELA understands Northern Beaches Council are preparing updated corridor mapping for the LGA. If this information becomes available prior to finalisation of the precinct plan it should be considered where relevant.

# 6. Conclusion

The Ingleside Precinct is in the Northern Beaches Local Government Area (LGA). This planning proposal covers an area of 176.36 ha and proposes to rezone a majority of the precinct to a variety of land use zones. The 61.40 ha of native vegetation across the precinct is likely to provide habitat for a range of threatened flora and fauna species in the form of breeding or foraging habitat. The precinct also contained 0.33 ha of PCT 978 which conforms to Coastal Upland Swamp which is listed as endangered under the BC Act and EPBC Act.

Under the proposed zoning, roughly three quarters of the vegetation will be retained in conservation zones, open space or rural land. This protects the key biodiversity corridors through the site. Unavoidable impacts will most likely require offsetting under the Biodiversity Assessment Method at the DA stage.

# 7. References

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# Appendix A Database species list

## Flora species

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Acacia bynoeana* | Bynoe's Wattle | E1 | V | Sept - Mar | | N/A | 2 | Unlikely, no records in 5 km radius. No suitable habitat due to soil types | no, this species is unlikely to occur in precinct |
| *Acacia prominens - endangered population* | - | E2 | - | All year | | N/A | 2 | Unlikely, no records in 5 km radius. No suitable habitat. Population does not occur in the area | no, this species is unlikely to occur in precinct |
| *Acacia pubescens* | Downy Wattle | V | V | All year | | N/A | 2 | Unlikely, no records in 5 km radius. No suitable habitat; occurs on shale sandstone transition soils | no, this species is unlikely to occur in precinct |
| ***Acacia terminalis* subsp. *terminalis*** | **Sunshine Wattle** | **E1** | **E1** | **All year** | | ✓ | **2** | **Potential, suitable habitat** | **yes** |
| *Allocasuarina portuensis* | - | E1 | E1 | All year | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Ancistrachne maidenii* | - | V | - | Dec - Feb | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Asterolasia elegans* | - | E1 | E1 | All year | N/A | 2 | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Caladenia tessellata* | Thick Lip Spider Orchid | E1 | V | Sept- Oct | N/A | 2 | 2 | Unlikely, no records in 5 km radius. No suitable habitat and only known from two locations in NSW | no, this species is unlikely to occur in precinct |
| ***Callistemon linearifolius*** | **Netted Bottle Brush** | **V** | **-** | **Sept - Mar** | ✓ | | **2** | **Potential, suitable habitat** | **Yes** |
| *Chamaesyce psammogeton* | Sand Spurge | E1 | - | n/a | ✓ | | | Unlikely, not suitable habitat | no, this species is unlikely to occur in precinct |
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | V | V | Nov - Feb | ✓ | ✓ | 2 | Unlikely, one old record | no, this species is unlikely to occur in precinct |
| ***Darwinia biflora*** | **-** | **V** | **V** | **Sept - Feb** | **N/A** | | **2** | **Potential, suitable habitat** | **yes** |
| *Darwinia glaucophylla* | - | V | - | All year | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Darwinia peduncularis* | - | V | - | All year | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Diuris bracteata* | - | E1 | - | n/a | ✓ | | | Unlikely, occurs in Gosford area. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Epacris purpurascens* var. *purpurascens*** | **-** | **V** | **-** | **All year** | ✓ | | **2** | **Potential, suitable habitat** | **Yes** |
| ***Eucalyptus camfieldii*** | **Camfield's Stringybark** | **V** | **V** | **All year** | ✓ | ✓ | **2** | **Potential, suitable habitat** | **Yes** |

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Eucalyptus nicholii* | Narrow-leaved Black Peppermint | V | V | n/a | ✓ | | | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Eucalyptus scoparia* | Wallangarra White Gum | E1 | V | n/a | ✓ | | | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Galium australe* | - | E1 | - | Nov - Mar | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Genoplesium baueri* | Bauer's Midge Orchid | E1 | - | Dec- Mar | ✓ | | 2 | Unlikely, old records | no, this species is unlikely to occur in precinct |
| *Grammitis stenophylla* | Narrow-leaf Finger Fern | E1 | - | n/a | ✓ | | | Unlikely, old records | no, this species is unlikely to occur in precinct |
| *Grantiella picta* | Painted Honeyeater | V | V | n/a | | ✓ | | Unlikely, suitable habitat is west of the dividing range | no |
| *Grevillea caleyi* | Caley's Grevillea | CE | E1 | All year | ✓ | ✓ | 1, 2 | Likely, previous records immediately adjacent to the precinct north of Mona Vale Road | no – after extensive survey none identified in the precinct |
| *Grevillea parviflora subsp. supplicans* | - | E1 | - | All year | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Haloragodendron lucasii* | - | E1 | E1 | All year | ✓ | ✓ | 2 | Unlikely, occurs outside study area | no, this species is unlikely to occur in precinct |

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Hibbertia puberula* | - | E1 | - | All year | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Hibbertia procumbens* | Spreading Guinea Flower | E1 | - | Dec - Mar | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Hygrocybe rubronivea* | - | V | - | May - Aug | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Kunzea rupestris* | - | V | V | All year | N/A | ✓ | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Lasiopetalum joyceae*** | **-** | **V** | **V** | **All year** | **N/A** | | **2** | **Potential, suitable habitat** | **yes** |
| ***Leptospermum deanei*** | **Leptospermum deanei** | **V** | **V** | **All year** | **N/A** | | **2** | **Potential, suitable habitat** | **yes** |
| *Melaleuca biconvexa* | Biconvex Paperbark | V | V | n/a | N/A | ✓ | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Melaleuca deanei*** | **Deane's Paperbark** | **V** | **V** | **Dec - Feb** | **1** | ✓ | **2** | **Potential, suitable habitat** | **yes** |
| *Melaleuca groveana* | Grove's Paperbark | V | - | All year | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Micromyrtus blakelyi* | - | V | V | All year | N/A | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Microtis angusii*** | **Angus's Onion Orchid** | **E1** | **E1** | **May - Oct** | **1** | ✓ | | **Known to occur** | **Yes** |

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Pelargonium sp. striatellum (G.W.Carr 10345)* | Omeo Stork's-bill | - | E1 | n/a | | ✓ | | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Persoonia hirsuta*** | **Hairy Geebung** | **E1** | **E1** | **Dec - May** | **1** | ✓ | **2** | **Potential, records in area** | **yes** |
| *Persoonia laxa* | - | Ex | Ex | n/a | 1 | | | Unlikely, presumed extinct | no, this species is unlikely to occur in precinct |
| *Persoonia mollis subsp. maxima* | - | E1 | E1 | All year | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| ***Pimelea curviflora var. curviflora*** | **-** | **V** | **V** | **All year** | **1** | ✓ | **2** | **Potential, records in area** | **yes** |
| *Prasophyllum fuscum (Tawny Leek-orchid)* | - | V | CE | Sept - Dec | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Prostanthera junonis* | - | E1 | E1 | Sept - Nov | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Prostanthera marifolia* | Seaforth Mintbush | CE | CE | n/a | 1 | ✓ | | Unlikely, outside study area | no, this species is unlikely to occur in precinct |
| *Pterostylis sp. Botany Bay* | - | E1 | E1 | Aug - Sept | | | 2 | Unlikely, outside study area | no, this species is unlikely to occur in precinct |
| *Streblus pendulinus* | Siah's Backbone | - | E | n/a | | ✓ | | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |

| Scientific Name | Common Name | Conservation status | | Survey Months | Data Source | | | Likelihood of occurrence | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | BC (5km) | EPBC (5km) | Other* | | |
| *Syzygium paniculatum* | Magenta Lilly Pilly | V | V | n/a | 1 | ✓ | | Unlikely, no suitable habitat | no, this species is unlikely to occur in precinct |
| ***Tetratheca glandulosa*** | **Glandular Pink-bell** | **V** | **V** | **Jul - Nov** | **1** | ✓ | **1, 2** | **Previous records.** | **yes** |
| *Thesium australe* | Austral Toadflax | V | V | n/a | | ✓ | | No. Habitat occurs west of the dividing range. | no |
| *Triplarina imbricata* | Creek Triplarina | E | E | n/a | N/A | ✓ | | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |
| *Wahlenbergia multicaulis - endangered population* | Tadgell's Bluebell | E2 | - | All year | | | 2 | Unlikely, no records in 5 km radius. No suitable habitat | no, this species is unlikely to occur in precinct |

Other*

1: ELA (2008)

2: Identified as a species credit species by the Biocertification Credit Calculator v1.09

It is noted that marine and migratory species from database searches are not included in this list.

## Fauna species

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| Amphibians | | | | | | | | | |
| ***Heleioporus australiacus* (Giant Burrowing Frog)** | **V** | **V** | **Sep - May** | ✓ | ✓ | **1, 2** | **Known, previously recorded in Ingleside Precinct** | **Yes** | **Yes.** |
| *Litoria aurea* (Green and Golden Bell Frog) | E1 | V | Aug - Mar | ✓ | ✓ | 2 | Unlikely, not suitable habitat, old record from 1975. | Yes | No, not predicted in the locality |
| *Litoria littlejohni* (Littlejohn's Tree Frog) | V | V | N/A | N/A | ✓ | | Unlikely, no records or suitable habitat present | - | No, not predicted in the locality |
| *Mixophyes balbus* (Stuttering Frog) | E1 | V | N/A | N/A | ✓ | | Unlikely, no records or suitable habitat present | - | No, not predicted in the locality |
| *Mixophyes iteratus (Giant Barred* Frog) | E1 | E1 | Oct - May | N/A | ✓ | 2 | Unlikely, no records or suitable habitat present | Yes | No. Highly unlikely that this species will occur in the study area. |
| ***Pseudophryne australis* (Red-crowned Toadlet)** | **V** | **-** | **All year** | **1** | **N/A** | **1 2** | **Known, previously recorded in Ingleside Precinct** | **Yes** | **Yes.** |
| Mammals (non-flying) | | | | | | | | | |
| *Dasyurus maculatus* (Spotted-tailed quoll) | V | E1 | N/A | ✓ | ✓ | 2 | Potential, previous records in Warriewood escarpment. | n/a | Potential foraging habitat (listed in report as ecosystem credit species under BAM). |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| ***Isoodon obesulus*** **(Southern Brown Bandicoot)** | **E1** | **E1** | **N/A** | ✓ | ✓ | **2** | **Potential, previously recorded in local area** | **N/A** | **Yes.** |
| ***Cercartetus nanus*** **(Eastern Pygmy Possum)** | **V** | **-** | **N/A** | ✓ | | **2** | **Known, recorded in Precinct** | **N/A** | **Yes.** |
| ***Petaurus australis*** **(Yellow-bellied Glider)** | **V** | **-** | **N/A** | **N/A** | **N/A** | **2** | **Unlikely, no records in 5 km radius** | | **Yes - Potential foraging habitat within the precinct. Further targeted survey ay be required.** |
| ***Petaurus norfolcensis*** **(Squirrel Glider)** | **V** | **-** | **N/A** | **N/A** | **N/A** | **2** | **Unlikely, no records in 5 km radius** | | **Yes - Potential foraging habitat within the precinct. Further targeted survey may be required.** |
| *Petrogale penicillata* (Brush-tailed Rock-wallaby) | E1 | V | N/A | N/A | ✓ | | Unlikely, no records in 5 km radius | | No |
| ***Phascolarctos cinereus*** **(Koala)** | **V** | **V** | **All year** | ✓ | ✓ | **2** | **Potential** | **Yes (ELA 2008)** | **Yes.** |
| ***Phascolarctos cinereus*** **(Koala)** **Pittwater endangered population** | **E2** | **V** | **All year** | ✓ | ✓ | | **Potential** | **Yes (ELA 2008)** | **Yes** |
| ***Potorous tridactylus tridactylus*** **(Long-nosed Potoroo)** | **-** | **V** | **N/A** | **N/A** | ✓ | | **Potential** | | **Yes - Potential foraging habitat within the precinct. Further targeted survey may be required.** |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| *Pseudomys novaehollandiae* (New Holland Mouse) | - | V | N/A | N/A | ✓ | | Unlikely, no records in 5 km radius | | No, not predicted in Locality |
| Mammals (flying) | | | | | | | | | |
| ***Chalinolobus dwyeri*** **(Large-eared Pied Bat)** | **V** | **V** | **Sep - May** | **N/A** | ✓ | **1, 2B** | **Known, has been recorded in area. Suitable foraging habitat present. No breeding** | **Yes** | **Yes -potential foraging habitat available within the precinct, and some potential breeding habitat within 2 km of the site** |
| ***Falsistrellus tasmaniensis*** **(Eastern False Pipistrelle)** | **V** | **-** | **N/A** | **N/A** | | **2** | **Potential, suitable habitat** | | **Yes -potential foraging habitat available within the precinct** |
| ***Miniopterus australis*** **(Little Bent-wing Bat)** | **V** | **-** | **N/A** | ✓ | | **2** | **Potential, suitable habitat** | | **Yes -potential foraging habitat available within the precinct** |
| ***Miniopterus schreibersii*** **subsp. *schreibersii*** **(Eastern Bent-wing Bat)** | **V** | **-** | **Sep - May** | ✓ | | **1, 2B** | **Known, has been recorded in area. Suitable foraging habitat. No breeding habitat present.** | **Yes** | **Yes -potential foraging habitat available within the precinct** |
| ***Micronomus norfolkensis*** **(Eastern Free-tailed Bat)** | **V** | **-** | **N/A** | ✓ | | | **Potential, recorded in Warriewood escarpment. Suitable foraging habitat present.** | **n/a** | **Yes, may be added as ecosystem credit species due to records in proximity to study area and presence of suitable habitat (tool did not predict this species)**** |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| ***Myotis macropus*** **(Southern Myotis) - breeding habitat** | **V** | **-** | **All year** | ✓ | | **2B** | **Potential, suitable foraging and breeding habitat** | **Yes** | **Yes - for breeding habitat.** |
| ***Pteropus poliocephalus*** **(Grey-headed Flying-fox)** | **V** | **V** | **Sep - May** | ✓ | ✓ | **2B** | **Known to foraging within study area. No breeding habitat present.** | **Yes** | **Yes -potential foraging habitat available within the precinct. No known camps present** |
| **Saccolaimus flaviventris** **(Yellow-bellied Sheathtail-bat)** | **V** | **-** | **N/A** | ✓ | | | **Potential, previous records.** | **n/a** | **Yes -potential foraging habitat available within the precinct** |
| **Scoteanax rueppellii** **(Greater Broad-nosed Bat)** | **V** | **-** | **N/A** | ✓ | | **2** | **Potential, recorded in Warriewood escarpment. Suitable foraging habitat.** | **n/a** | **Yes -potential foraging habitat available within the precinct** |
| Birds (diurnal) | | | | | | | | | |
| *Anthochaera phrygia* (Regent Honeyeater) | CE | E1 | N/A | ✓ | ✓ | 1, 2 | Infrequent vagrant species. Potential foraging habitat present for vagrant individuals. | | This species would occur only occasionally as vagrant individuals briefly move through the Precinct whilst migrating, and is unlikely to be present in the Precinct |
| *Botaurus poiciloptilus* (Australasian Bittern) | E1 | E1 | N/A | N/A | ✓ | 1 | Unlikely. Old sightings from Council records prior to urban development. | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Burhinus grallarius* | E1 | - | | | | | Unlikely - vagrant | | No, not predicted in Locality |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| (Bush Stone-curlew) | | | | | | | | | |
| ***Callocephalon fimbriatum* (Gang-gang Cockatoo)** | **V** | **-** | **N/A** | ✓ | | **2** | **Potential, previous records in 5 km radius. Suitable habitat in study area.** | **Yes** | **Yes. Potential foraging habitat in the precinct** |
| *Callocephalon fimbriatum* (Gang-gang Cockatoo) - endangered population | E2 | - | | | | | Located outside the precinct area. this endangered population is unlikely to occur within the precinct. | | No. |
| *Calyptorhynchus lathami* (Glossy Black-cockatoo) | V | - | N/A | ✓ | | 1, 2 | Potential, previous records | | **Yes. Potential foraging habitat in the precinct** |
| *Daphoenositta chrysoptera* (Varied Sittella) | V | - | | ✓ | | | Unlikely, no suitable habitat | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Dasyornis brachypterus* (Eastern Bristlebird) | E1 | E1 | All year | N/A | ✓ | | Unlikely, no records in 5 km radius | Yes | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Erythrotriorchis radiatus* (Red Goshawk) | CE | V | N/A | N/A | ✓ | | Unlikely, no records in 5 km radius | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Ixobrychus flavicollis* (Black Bittern) | V | - | | ✓ | - | 1 | Unlikely. Old sightings from Council records prior to urban development. Vagrant species only | | No, not predicted in Locality. This species is unlikely to occur in the area. |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| ***Glossopsitta pusilla*** **(Little Lorikeet)** | **V** | **-** | **N/A** | ✓ | | **2** | **Potential, previous records and suitable habitat present** | | **Yes. Potential foraging habitat in the precinct** |
| ***Hieraaetus morphnoides*** **(Little Eagle)** | **V** | **-** | **All year** | ✓ | | **2** | **Potential, previous records and suitable habitat present** | **Yes** | **Yes. Potential foraging habitat in the precinct** |
| *Lathamus discolor* (Swift Parrot) | E1 | E1, Ma | N/A | ✓ | | 2 | Potential, previous records | | This species would occur only occasionally as vagrant individuals briefly move through the Precinct whilst migrating, and is unlikely to be present in the Precinct |
| *Pandion cristatus* (Eastern Osprey) | V | - | | ✓ | | | Unlikely, suitable habitat located outside study area | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Petroica boodang* (Scarlet Robin) | V | - | | N/A | | 2 | Potential (non-breeding) | | No. This is an ecosystem credit species |
| *Ptilinopus magnificus* (Wompoo Fruit Dove) | V | - | | ✓ | | | Unlikely, only one record in 5 km radius from 1985. | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| *Neophema pulchella* (Turquoise Parrot) | V | - | | ✓ | | 1 | Unlikely, Council predicts locally extinct. No suitable habitat. Previous record from 1983. | | No. Species unlikely to occur. Last record in area is from 1983. |
| *Rostratula australis* (Australian Painted Snipe) | E1 | E1 | N/A | N/A | 2 | | Unlikely | | No, not predicted in Locality. This species is unlikely to occur in the area. |
| Birds (nocturnal) | | | | | | | | | |

| Target Species or Type | BC Act | EPBC Act | Survey Months | Data Source | | | Likelihood of Occurrence | Field survey within survey months | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | BC (5km) | EPBC (5km) | Other* | | | |
| ***Ninox connivens*** **(Barking Owl)** | V | - | N/A | ✓ | | 1 | Known, suitable habitat present | | Yes, may be added as ecosystem credit species due to records in proximity to study area and presence of suitable habitat (tool did not predict this species)** |
| ***Ninox strenua*** **(Powerful Owl)** | V | - | N/A | ✓ | | 1 | Known, suitable habitat present | | Yes, may be added as ecosystem credit species due to records in proximity to study area and presence of suitable habitat (tool did not predict this species)** |
| ***Tyto novaehollandiae*** **(Masked Owl)** | V | - | | | | 1 | Potential, suitable habitat present | | Yes, may be added as ecosystem credit species due to records in proximity to study area and presence of suitable habitat (tool did not predict this species)** |
| ***Tyto tenebricosa*** **(Sooty Owl)** | V | - | | | | 1 | Old Council records. Presumed locally extinct | No | Yes, may be added as ecosystem credit species due to records in proximity to study area and presence of suitable habitat (tool did not predict this species)** |
| Reptiles | | | | | | | | | |
| ***Hoplocephalus bungaroides*** **(Broad-headed snake)** | E1 | V | Mar - Nov | n/a | ✓ | 2 | Unlikely, no records in 5 km radius and no suitable habitat. | No | potential. Some areas of suitable habitat in the precinct. |
| ***Varanus rosenbergi*** **(Rosenberg's Goanna )** | V | - | Nov - Feb | ✓ | | | Previous records. Suitable habitat present | Yes | Yes. This species is known to occur in the region |

* Other: 1: ELA (2008)

2: Identified as an ecosystem or species credit species by the Biocertification Credit Calculator v1.09

2B Identified as species credit species (breeding) by the Biocertification Credit Calculator v1.09

**May be added by OEH in the future as the vegetation types and associated data are currently under review.

# Appendix B Species credit species

## Flora Species

| Scientific Name | Common Name | Conservation status | | Survey Months and whether field survey occurred in those months | Habitat requirements | Associated Vegetation Zones | Characteristics used during Field Survey Ground-truthing |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Acacia terminalis* subsp. *terminalis* | Sunshine Wattle | E | E | All year<br>Yes | *Acacia terminalis* subsp. *terminalis* has a very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. It occurs in coastal scrub and dry sclerophyll woodland on sandy soils (DECC 2007). | 1250, 1083, 881, 882, non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Callistemon linearifolius* | Netted Bottle Brush | V | - | Sept – Mar<br>Yes | *Callistemon linearifolius* has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW, growing in dry sclerophyll forest (DECC 2007). For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (DECC 2007). | 882, 1083, 1181, 1250 non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Darwinia biflora* | - | V | V | Sept – Feb<br>Yes | *Darwinia biflora* is an erect or spreading shrub to 80cm high associated with habitats where weathered shale capped ridges intergrade with Hawkesbury Sandstone, where soils have high clay content (NPWS 1997). | 882, 1083, 1250 non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Epacris purpurascens* | - | V | - | All year<br>Yes | *Epacris purpurascens* var. *purpurascens* has been recorded between Gosford in the north to Avon Dam in the south, in a range | 1083, 1250, 1181 non- | Vegetation not affected by moderate to high levels of |

| Scientific Name | Common Name | Conservation status | | Survey Months and whether field survey occurred in those months | Habitat requirements | Associated Vegetation Zones | Characteristics used during Field Survey Ground-truthing |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *var. purpurascens* | | | | | of habitats, but most have a strong shale soil influence (DECC 2007). | weedy, non-fragmented | disturbance including weed invasion |
| *Eucalyptus camfieldii* | Camfield's Stringybark | V | V | All year Yes | *Eucalyptus camfieldii* is associated with shallow sandy soils bordering coastal heath with other stunted or mallee eucalypts, often in areas with restricted drainage and in areas with laterite influenced soils, thought to be associated with proximity to shale (DECC 2007). | 882, 1083, non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Lasiopetalum joyceae* | - | V | V | All year Yes | *Lasiopetalum joyceae* grows in ridgetop woodland, heath, woodland or open scrub, often with a clay influence (NPWS 1997). | 882, 1083, 1181 non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Leptospermum deanei* | Leptospermum deanei | V | V | All year Yes | *Leptospermum deanei* has been recorded in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs, in woodland on lower hill slopes or near creeks, at sites with sandy alluvial soil or sand over sandstone (DECC 2007). It has also been recorded in riparian scrub dominated by *Tristaniopsis laurina* and *Baeckea myrtifolia*; woodland dominated by *Eucalyptus haemastoma*; and open forest dominated by *Angophora costata, Leptospermum trinervium* and *Banksia ericifolia* (DECC 2007). | 1181, 1250, non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |
| *Melaleuca deanei* | Deane's Paperbark | V | V | Dec – Feb Yes | Found in heath on sandstone (DEC 2005), and also associated with woodland on broad ridge tops and slopes on sandy loam | HN 566, 567, HN 541 HN 540, 1250, non-weedy, | Vegetation not affected by moderate to high levels of disturbance including weed invasion |

| Scientific Name | Common Name | Conservation status | | Survey Months and whether field survey occurred in those months | Habitat requirements | Associated Vegetation Zones | Characteristics used during Field Survey Ground-truthing |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| | | | | | and lateritic soils (Benson and McDougall 1998). | non-fragmented | |
| *Microtis angusii* | Angus's Onion Orchid | E | E | May – Oct<br>No – though RMS survey results available | Currently only known from one site at Ingleside in the north of Sydney (DEC 2005). The dominant species occurring on the highly disturbed Ingleside site are introduced weeds *Hyparrhenia hirta* (Coolatai grass) and *Acacia saligna* (ibid.). Most likely associated with the Duffys Forest vegetation community (ibid.). Exists as subterranean tubers during most of the year, producing leaves and then flowering stems in late winter and spring and flowers from May to October (ibid.). By summer, the above ground parts have withered leaving no parts above ground (ibid.). | 50m vegetation buffer along Mona Vale Road | New information received from RMS – details to be sought |
| *Persoonia hirsuta* | Hairy Geebung | E | E | Dec – May<br>Yes | *Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (DECC 2007). It grows in dry sclerophyll eucalypt woodland and forest on sandstone (PlantNet 2014). | 1083, 1250, 1181, 882, non-weedy, non-fragmented | May be associated with lateritic soil profile, however may also occur on sandstone derived soils |
| *Pimelea curviflora* var. *curviflora* | - | V | V | All year<br>Yes | *Pimelea curviflora* var. *curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shale/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (DECC 2007). Associated with the Duffys Forest Community, shale lenses on ridges in | 882, 881, 1083 non-weedy, non-fragmented | Vegetation not affected by moderate to high levels of disturbance including weed invasion |

| Scientific Name | Common Name | Conservation status | | Survey Months and whether field survey occurred in those months | Habitat requirements | Associated Vegetation Zones | Characteristics used during Field Survey Ground-truthing |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| | | | | | Hawkesbury sandstone geology (Pittwater Council 2000). | | |
| *Tetratheca glandulosa* | Glandular Pink-bell | V | V | Jul – Nov<br>No | Associated with ridgetop woodland habits on yellow earths (Travers Morgan 1990) also in sandy or rocky heath and scrub (NPWS 1997). Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November. | 881, 882, 1083, 1250, non-weedy, non-fragmented | Usually associated with sandstone ridgetop midslope landscapes |

* Spatial = A broad assessment was made based on whether a threatened flora species would occur in fragmented habitat areas, or only in habitat that is relatively contiguous with core habitat areas (being the large tracts of vegetation that occur within Ku-ring-gai Chase National Park, Garigal National Park, Minkara Reserve, Katandra Bushland Sanctuary, and Ingleside Chase Reserve).

# Appendix C Incidental fauna list

| Family | Common Name | Scientific Name | Observation |
|---|---|---|---|
| Amphibians | | | |
| Myobatrachidae | Common Eastern Froglet | *Crinia signifera* | W |
| Aves | | | |
| Acanthizidae | Brown Thornbill | *Acanthiza pusilla* | O |
| | Weebill | *Smicrornis brevirostris* | O |
| Anatidae | Grey Teal | *Anas gracilis* | O |
| | Pacific Black Duck | *Anas superciliosa* | O |
| | Australian Wood Duck | *Chenonetta jubata* | O |
| Apodidae | White-throated Needletail | *Hirundapus caudacutus* | O |
| Ardeidae | White-necked Heron | *Ardea pacifica* | O |
| | White-faced Heron | *Egretta novaehollandiae* | O |
| Artamidae | Grey Butcherbird | *Cracticus torquatus* | O |
| | Australian Magpie | *Gymnorhina tibicen* | O |
| | Pied Currawong | *Strepera graculina* | O |
| Cacatuidae | Sulphur-crested Cockatoo | *Cacatua galerita* | O |
| | Yellow-tailed Black Cockatoos | *Calyptorhynchus funereus* | O |
| | Galah | *Eolophus roseicapillus* | O |
| Campephagidae | Black-faced Cuckoo-shrike | *Coracina novaehollandiae* | O |
| Charadriidae | Masked Lapwing | *Vanellus miles* | O |
| Climacteridae | White-throated Treecreeper | *Cormobates leucophaea* | W |
| Columbidae | Rock Dove* | *Columba livia* | O |
| | Peaceful Dove | *Geopelia striata* | O |
| | Brown Cuckoo-Dove | *Macropygia amboinensis* | O |
| | Crested Pigeon | *Ocyphaps lophotes* | O |
| | Common Bronzewing | *Phaps chalcoptera* | O |
| | Spotted Dove | *Spilopelia chinensis* | O |
| Coraciidae | Dollarbird | *Eurystomus orientalis* | O |
| Corvidae | Australian Raven | *Corvus coronoides* | O |
| Cuculidae | Fan-tailed Cuckoo | *Cacomantis flabelliformis* | W |
| | Pheasant Coucal | *Centropus phasianinus* | W |
| | Eastern Koel | *Eudynamys orientalis* | O |
| | Channel-billed Cuckoo | *Scythrops novaehollandiae* | O |
| Estrildidae | Red-browed Finch | *Neochmia temporalis* | O |

| Family | Common Name | Scientific Name | Observation |
|---|---|---|---|
| Eupetidae | Eastern Whipbird | *Psophodes olivaceus* | W |
| Falconidae | Peregrine Falcon | *Falco peregrinus* | O |
| Halcyonidae | Laughing Kookaburra | *Dacelo novaeguineae* | O |
| | Sacred Kingfisher | *Todiramphus sanctus* | O |
| Hirundinidae | Welcome Swallow | *Hirundo neoxena* | O |
| Maluridae | Superb Fairy-wren | *Malurus cyaneus* | O |
| | Variegated Fairy-wren | *Malurus lamberti* | O |
| Megapodiidae | Tawny Frogmouth | *Podargus strigoides* | O |
| Meliphagidae | Eastern Spinebill | *Acanthorhynchus tenuirostris* | O |
| | Red Wattlebird | *Anthochaera carunculata* | O |
| | Little Wattlebird | *Anthochaera chrysoptera* | O |
| | Noisy Miner | *Manorina melanocephala* | O |
| | Lewins Honeyeater | *Meliphaga lewinii* | W |
| | White-cheeked Honeyeater | *Phylidonyris niger* | O |
| | New Holland Honeyeater | *Phylidonyris novaehollandiae* | O |
| Monarchidae | Magpie-lark | *Grallina cyanoleuca* | O |
| Oriolidae | Olive-backed Oriole | *Oriolus sagittatus* | W |
| Pachycephalidae | Golden Whistler | *Pachycephala pectoralis* | W |
| | Rufous Whistler | *Pachycephala rufiventris* | W |
| Pardalotidae | Spotted Pardalote | *Pardalotus punctatus* | W |
| | Striated Pardalote | *Pardalotus striatus* | W |
| Petroicidae | Eastern Yellow Robin | *Eopsaltria australis* | O |
| Phalacrocoracidae | Little Black Cormorant | *Phalacrocorax sulcirostris* | O |
| Phasianidae | Indian Peafowl | *Pavo cristatus* | O |
| Podargidae | Australian Brush-turkey | *Alectura lathami* | O |
| Psittacidae | King Parrot | *Alisterus scapularis* | O |
| | Crimson Rosella | *Platycercus elegans* | W |
| | Eastern Rosella | *Platycercus eximius* | W |
| | Rainbow Lorikeet | *Trichoglossus haematodus* | O |
| Pycnonotidae | Red-whiskered Bulbul* | *Pycnonotus jocosus* | O |
| Rallidae | Eurasian Coot | *Fulica atra* | O |
| | Buff-banded Rail | *Gallirallus philippensis* | O |
| | Purple Swamphen | *Porphyrio porphyrio* | O |
| Rhipiduridae | Grey Shrike-thrush | *Colluricincla harmonica* | W |
| | Grey Fantail | *Rhipidura albiscapa* | O |

| Family | Common Name | Scientific Name | Observation |
|---|---|---|---|
| | Willie Wagtail | *Rhipidura leucophrys* | O |
| Sturnidae | Common Myna* | *Sturnis tristis* | O |
| | Common Starling* | *Sturnus vulgaris* | O |
| Timaliidae | Silvereye | *Zosterops lateralis* | W |
| *MAMMALS* | | | |
| Canidae | Domestic Dog* | *Canis lupus familiaris* | O |
| | European Red Fox* | *Vulpes vulpes* | Scats, Bird kill |
| Equidae | Domestic Horse* | *Equus ferus caballus* | O |
| Leporidae | European Rabbit* | *Oryctolagus cuniculus* | O |
| Macropodidae | Swamp Wallaby | *Wallabia bicolor* | O |
| Peramelidae | Long-nosed Bandicoot | *Perameles nasuta* | Killed, diggings |
| Petauridae | Sugar Glider | *Petaurus breviceps* | Feeding scars |
| Phalangeridae | Common Brushtail Possum | *Trichosurus vulpecula* | Killed, scats |
| Pseudocheiridae | Common Ringtail Possum | *Pseudocheirus peregrinus* | O, Drey |
| REPTILE | | | |
| Agamidae | Jacky Lizard | *Amphibolurus muricatus* | O |
| Agamidae | Eastern Water Dragon | *Physignathus lesueurii* | O |
| Elapidae | Red-bellied Black Snake | *Pseudechis porphyriacus* | O |
| | Eastern Brown Snake | *Pseudonaja textilis* | O |
| Scincidae | Eastern Water Skink | *Eulamprus quoyii* | O |
| | Garden Skink | *Lampropholis delicata* | O |
| Varanidae | Lace Monitor | *Varanus varius* | O |
| * denotes introduced species | | | |
| O = Observed | | | |
| W = Heard | | | |

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